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Covering the Literature on Atomic Energy
in the Fields of

Biology Medicine Chemistry
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NSA, Vol. 5, No. 9. In abstract 2158, last line of heading, add (TT-140).

NSA, Vol. 5, No. 18. In abstract 4854, last line of heading, add (AERE-Inf/Bib-75). In Reports Reference List, page vii, NP-3052 should be NP-3252.

NSA, Vol. 5, No. 18. In abstract 4669, a line reading "radioiodine and the rate of its excretion. In the suckling litter" should be inserted between the tenth and eleventh lines of the abstract as printed.

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AD-309(B)	A Quantitative Study of Percutaneous Absorption; V. Treatment of Contaminated Skin and Wounds to Prevent Absorption of Radioactive Salts. (Technical Objective AW-6). R. Kenneth Loeffler and John W. Herron.	4996

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NP-1999	Nuclear Shielding Studies; XI. Fast Neutron Spectra Measured by the Photographic Plate Method. (Technical Report No. 47) P. H. Stelson.	5346
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NP-3192	Study of a Proton Accelerator. (Technical Report No. 5) Michael J. Ozeroff.	5274
NP-3237	Report of Symposium IV; Chemistry and Physics of Radiation Dosimetry [held at the] Army Chemical Center 18, 19, and 20 September 1950; Part I–Unclassified Papers. George B. Wilson, Chairman.	5100

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NP-3237 (paper 3)	Solvent Activated Radiation Reactions in Aqueous Solutions, paper 3 of Report of Symposium IV; Chemistry and Physics of Radiation Dosimetry [held at the] Army Chemical Center 18, 19, and 20 September 1950; Part I–Unclassified Papers. Hugo Fricke.	5109
NP-3237 (paper 4)	Theory of Radiation Chemistry, I. Some Chemical Effects of Variation of Ionization Density, paper 4 of Report of Symposium IV; Chemistry and Physics of Radiation Dosimetry [held at the] Army Chemical Center 18, 19, and 20 September 1950; Part I–Unclassified Papers. John L. Magee.	5110
NP-3237 (paper 5)	Crystal Chemistry of Defective Structures with Respect to Radiation, paper 5 of Report of Symposium IV; Chemistry and Physics of Radiation Dosimetry [held at the] Army Chemical Center 18, 19, and 20 September 1950; Part I–Unclassified Papers. W. A. Weyl.	5082
NP-3237 (paper 6)	Luminescent Solids (Phosphors), paper 6 of Report of Symposium IV; Chemistry and Physics of Radiation Dosimetry [held at the] Army Chemical Center 18, 19, and 20 September 1950; Part I–Unclassified Papers. H. W. Leverenz.	5249
NP-3237 (paper 7)	Effect of Radiation on Colloidal and High Polymeric Substances, paper 7 of Report of Symposium IV; Chemistry and Physics of Radiation Dosimetry [held at the] Army Chemical Center 18, 19, and 20 September 1950; Part I–Unclassified Papers. Malcolm Dole.	5111
NP-3237 (paper 8)	Thermoluminescence and Related Properties of Crystals, paper 8 of Report of Symposium IV; Chemistry and Physics of Radiation Dosimetry [held at the] Army Chemical Center 18, 19, and 20 September 1950; Part I–Unclassified Papers. Farrington Daniels.	5250
NP-3237 (paper 9)	The UCLA Dosimeter, Its Recent Modifications and Additional Applications, paper 9 of Report of Symposium IV; Chemistry and Physics of Radiation Dosimetry [held at the] Army Chemical Center 18, 19, and 20 September 1950; Part I–Unclassified Papers. George V. Taplin, Clayton Douglas, and Butler Sanchez.	5327
NP-3240	Development of Ceramic Materials of High Electrical Conductivity (Quarterly Report No. 2).	5185
NP-3269	Use of High Vacuum Tube as a Grid Controlled Rectifier in Stabilized High Voltage Power Supplies; Radioactivity Division. (Topical Report No. TR-86/51) J. E Wilson.	5275
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PA-13	Path and Energy of a Charged Particle in a Varying Magnetic Field. G. H. Godfrey.	5241
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TEI-148-A	Summary of the Research Work of the Trace Elements Section, Geochemistry and Petrology Branch, for the Period April 1, 1948–December 31, 1950. John C. Rabbitt.	5219
TEI-152	A Photometric Method for the Estimation of the Oil Yield of Oil Shale. (Trace Elements Investigations Report No. 152) Frank Cuttitta.	5187
TEM-183-A	Interim Report of Geologic Investigation, Lost Creek Schroeckingerite Deposits, Sweetwater County, Wyoming. L. R. Page.	5220

GENERAL

ATOMIC POWER

4931

Mound Lab.

A METHOD OF PRODUCING AN ELECTRIC CURRENT FROM RADIOACTIVITY. P. E. Ohmart. Sept. 11, 1950. 6p. (MLM-495)

Experiments have shown that if a cell, made up of two electrochemically dissimilar materials separated by a gas, is connected to a current measuring device, a small continuous current will be caused to flow from the more noble to the more active electrode without an external source of voltage when the separating gas is forcibly ionized by exposure to nuclear radiation. The current thus produced has been found to be dependent on the nature of the electrodes and their surfaces, the type and flux density of the energizing radiation, the type and pressure of the filling gas, and when excited by γ radiation, the γ-stopping power of the electrodes. (auth)

BIOLOGY AND MEDICINE

4932

Argonne National Lab.

EXHIBIT-RADIOAUTOGRAPHS OF U^{233} IN BONE AND SOFT TISSUE. James S. Arnold. Mar. 1951. Decl. June 6, 1951. 17p. (AECD-3176)

A series of radioautographs is presented showing deposition of U^{233} and Pu in the bone and soft tissues of animals, sacrificed at periods varying from 24 hr to 4 yr following injection.

4933

Radiation Lab., Univ. of Calif.

MEDICAL AND HEALTH PHYSICS QUARTERLY REPORT; JANUARY, FEBRUARY, AND MARCH, 1951. May 8, 1951. 76p. (AECD-3219)

Separate abstracts have been prepared on the following sections of this report: Metabolic Properties of Various Materials, p.4-40; Biological Studies of Radiation Effects, p.41-72.

4934

INORGANIC COMPOUNDS INDUCING MUTATION IN USTILAGO ZEAE. J. B. Rowell and E. C. Stakman. [nd] 1p. (AECU-1310)

The report is reproduced here in its entirety.

Ustilago zeae in culture is sensitive to the mutagenic action of environmental factors, such as heat and aging, and many mutants are readily detected as sectors in the fungus colony. Representative lines of U. zeae were grown on potato-dextrose agar containing various inorganic compounds to determine the mutational response. The four lines tested were the two compatible lines, stable 10A4 and mutable 17D4, and the two diploid lines, stable 410n and mutable 410qq, which are progeny of a cross of the two haploids. Compounds found to be effective in causing sector production are uranyl nitrate, thorium nitrate, sodium arsenite, lithium chloride, mercury bichloride, copper sulfate, and tantalum potassium fluoride. Mutants were induced in both haploid and diploid lines regardless of whether they were stable or mutable. Studies of some of the mutants have demonstrated differences from the parent line in cultural, morphological, and pathogenic characters. The phenomenon is intensified by high temperature and aging, while pH affects the activity of each compound individually depending on the acidic or basic nature of its effective radical. There is no chemical similarity among the materials found to be mutagenic. All are inhibitory to growth, however, and the mutant sectors are produced in a narrow range of concentration near the threshold of complete growth inhibition. Most, but not all, of the variants were more tolerant to the mutagenic agent than the parental line upon re-exposure to the compound in culture after being carried for several cultural generations on plain potato-dextrose agar. The mechanism by which the chemicals induce mutation is unknown, although the appearance of the sectors on media containing toxic quantities of these compounds may be partially effected through a selective process.

4935

Brookhaven National Lab.

THE CORRELATION OF MANGANESE CONTENT AND FLOWER COLOR IN LILACS. Vaughan T. Bowen. [nd] 12p. (AECU-1403)

Evidence is presented of difference in accumulation of Mn by white vs. purple flowered specimens of Syringa vulgaris. This is shown to have been lost by various hybrids

and horticultural varieties. It appears that Mn uptake is not associated with pigment formation, and that differences in accumulation power are due to different processes of Mn immobilization, not to differences in rate of transport. (auth)

4936

Virus Lab., Henry Ford Hospital

LYMPHOID LESIONS IN POLIOMYELITIS. Sheldon C. Sommers, Joan C. Wilson, and Frank W. Hartman. [nd] 13p. (AECU-1437)

Examination of 50 autopsied cases of human poliomyelitis showed prominent hyperplastic and inflammatory changes in the lymphoid tissues of 41, which, aside from the central nervous system damage, was the most frequent and severe lesions observed. Histologically germinal centers showed prominent degenerative and regenerative alterations, fluid transudation, giant cell formation and rare inclusion bodies, all consistent with virus effects. Treatment of mice with total body x-ray, aminopterin (4-aminopterolglutamic acid), and adrenocorticotropic hormone resulted in increased incidences of poliomyelitis infections after intraperitoneal introduction of MEF (Middle Eastern Forces) virus. This was ascribed to the damage to lymphoid tissues produced by these agents. Based on combined morphologic and virus studies, the presence of gastrointestinal, lymphoid, brain-blood and nerve cell defense barriers to poliomyelitis virus is suggested. (auth)

4937

Illinois Univ. Coll. of Agriculture

CONTENT OF HUMAN TISSUES IN ELEVEN TRACE MINERALS; PROGRESS REPORT. June 15, 1951. 7p. (AECU-1530)

Progress is reported on a project which involves chemical analysis of a sufficient number of selected cadavers to indicate normal occurrence of trace minerals in human tissues, and the variation of concentration of these elements due to advancing age. Elements to be studied include B, Sr, Co, Be, Ga, Hg, Po, Ra, Th, U, and Zr. Chemical analytical methods of biological materials for B, Sr, and Co are discussed briefly. A chemical analytical method for Be is discussed in detail. A search of the literature from 1940 through 1951 on the chemical analysis for the trace elements is mentioned, the articles being abstracted on library cards and filed.

4938

Los Alamos Scientific Lab.

CRITICAL ULTRACENTRIFUGAL AND VISCOSITY STUDIES ON BOVINE FIBRINOGEN. Virgil L. Koenig and J. D. Perrings. [nd] 19p. (AECU-1568)

Ultracentrifugal and viscosity studies have been carried out on bovine fibrinogen at various temperatures using 0.2M NaCl and 0.1M Na HPO_4 as solvents for the protein. Significant differences in the values of S_{20} at zero concentration and in the slopes of the lines of regression were observed when the determinations were carried out at various temperatures and corrected by the conventional formula to 20°C and water as the solvent. These differences are explained by the changes in viscosity of the fibrinogen solution with change in temperature. The incorporation of the viscosity of the fibrinogen solution into the correction formula rather than the viscosity of the solvent gave a better correction factor. Differences were observed in the lines of regression for S_{20} on concentration when fibrinogen was ultracentrifuged at various speeds, indicating orientation of the fibrinogen molecule. The fact that the fibrinogen molecule has tendency to orient indicates that it is a rigidly asymmetric molecule.

4939

Argonne National Lab.

ACTION OF MALEIC HYDRAZIDE ON PARAMECIUM AURELIA. E. L. Powers and C. F. Ehret. July 31, 1951. 5p. (AECU-1576; UAC-426)

In contrast to a recent report (Darlington and McLeish, Nature 167, 407 (1951)) on induction of chromosome breaks in Vicia faba by treatment with maleic hydrazide, a plant-growth inhibitor, no deleterious genetic effects have been observed in Paramecium aurelia exposed to nonlethal concentrations of this compound.

4940

Western Reserve Univ.

MONTHLY PROGRESS REPORT APRIL 1951. Hymer L. Friedell. June 30, 1951. 9p. (NYO-1630)

A satisfactory colloidal preparation of $CrPO_4$ was prepared and administered intravenously to experimental animals. Distribution studies showed approximately 80 to 90% of the colloid remains in the circulation after 1 hr. Within 24 hr the $CrPO_4$ is deposited in the liver, spleen, bone marrow, and bone in that order in terms of per cent of injected dose. Measurements of the stroke output of the heart, using I^{131}, have been correlated with the standard Fick method and the study continued on four patients. Calculated outputs have agreed within the expected experimental error. The determination of the cardiac output of dogs with cardiac outputs as high as 3 times their blood volume per minute has been continued. A preliminary experiment to determine the effect of propylene glycol on the toxicity of nitrogen mustard was completed. Two rabbits given propylene glycol only showed no toxic manifestations and no decrease in leucocytes. Three rabbits given nitrogen mustard alone (2 mg/kg) showed moderate toxic reactions. The leucocytes fell precipitously from an average normal of 11,400 per mm^3 to 1,720 per mm^3 72 hr after the injections. All animals survived for more than 30 days. The leucocyte values returned to the normal range. Three rabbits were given propylene glycol (4 cc/kg) and nitrogen mustard (2 mg/kg). Two of the three animals died within 24 hr. The surviving animal showed the same precipitous decrease in leucocytes as was seen in those animals given nitrogen mustard alone. This animal survived the 30-day observation period with a return of the leucocytes to a normal value.

4941

Western Reserve Univ.

MONTHLY PROGRESS REPORT MAY 1951. Hymer L. Friedell. July 6, 1951. 8p. (NYO-1631)

Studies of the effects of further irradiation upon irradiation damaged hematopoietic systems of animals, using injected doses of P^{32} and Au^{198}, lend further support to the theory that hematopoietic depression is the determining factor in survival. Studies of the toxicity and distribution of $CrPO_4$ show the deposition to radio resistant tissues such as liver allows less of the radiation to be effective in producing hematopoietic depression. The spleen is severely injured by 20% of the injected dose, but the sparing action on the bone marrow is believed to be of greater significance in animal mortality. From a study of the effect of peritoneal lavage on survival of x-irradiated dogs it is concluded that it is unlikely lavage treatment benefits irradiated animals significantly. Effects of x-ray irradiation on protein digestion and absorption in dogs were studied. Normal protein digestion curves were established on each of 6 dogs. After 550 r of x irradiation, the digestion tests were repeated at weekly intervals. Two of the 13 post-irradiation tests indicated impairment of digestion and/or absorption on the day before death of the animal.

4942

Oak Ridge National Lab.

STUDIES OF RADIOACTIVITY IN FISH FROM WHITE OAK

LAKE AND THE CLINCH RIVER. Venus I. Knobf. July 9, 1951. 39p. (ORNL-1031)

Fish in the White Oak Creek drainage system were scanned for over-all radioactivity; samples of bone, scale, and flesh were taken and in some cases internal organs were processed. Sr^{89}, Sr^{90}, and Y^{90} were found to be responsible for most of the activity in bones and scales, while Cs^{137} accounted for 96.8% of the activity in the flesh. Fish in White Oak Lake are unsafe as food and those in the river are not recommended, but those in the Clinch River appear to have insignificant activity.

4943

North Carolina Univ. and Oak Ridge Inst. of Nuclear Studies
AN EXPENDABLE CAGE TO SEPARATE THE URINE AND FECES OF RATS IN TRACER EXPERIMENTS. H. D. Bruner. [nd] 2p. (ORO-5)

A rat cage is described for tracer experiments where it is essential to obtain urine and feces free of contamination from each other. The urine falls through a galvanized hardware-cloth floor to be absorbed on a paper cone. The feces roll down the sloping paper surface to collect in an evaporating dish. Food crumbs also fall into the dish, but the pellets can be picked out without difficulty.

4944

Atomic Energy Project, Univ. of Calif., Los Angeles
HIGH SPEED PHOTOGRAPHY OF THE MOTION OF MICE SUBJECTED TO LABORATORY PRODUCED AIR BLAST. B. Cassen, P. Kalian, and H. Gass. May 25, 1951. 15p. (UCLA-138)

Equipment is described for subjecting to air blast mice that are essentially mechanically unconstrained at the instant they are struck. A series of frames of their subsequent motion taken at about 2400 frames/sec is reproduced. In all cases where the incident pulse strikes a part of the animal first, that part is accelerated relative to the animal as a whole, thereby producing much compression and distortion of its body. Following this the initially unconstrained animal flies off at high speed and usually undergoes a twisting, rotating, and rising motion as it rebounds from the initial impact. The sequence of events which are capable of influencing the injuries which the animal sustains are now capable of being analyzed by this technique. (auth)

4945

Atomic Energy Project, Univ. of Calif., Los Angles
A SATISFACTORY APPARATUS FOR PROLONGED AND REPEATED INTRAVENOUS INFUSIONS IN RABBITS. Lawrence E. Detrick and Bonnie Rhodes. Aug. 6, 1951. 7p. (UCLA-146)

Repeated and prolonged intravenous infusions have been accomplished in rabbits via an indwelling polyethylene catheter assembly featuring a solic nylon stylet in situ between injection periods to assure capillary tube patency. A simple yet effective hypodermic needle adapter cannula closure and anchoring method that served as the only form of external apparatus protection are described. (auth)

4946

Atomic Energy Project, Univ. of Calif., Los Angeles
ABSORPTION AND DISTRIBUTION STUDIES USING ELEOSTEARIC ACID. Dorothy L. Fillerup and James F. Mead. Aug. 7, 1951. 22p. (UCLA-148)

The absorption of methyl oleate by mice can be accurately measured using nonradioactive methyl eleostearate as a tracer. The same tracer also finds application in the tracing of fat absorption and distribution in the rat. Evidence is presented in favor of its use in human studies. (auth)

4947

Atomic Energy Project
Univ. of Calif., Los Angeles
THE EFFECT OF ULTRACENTRIFUGAL FRACTIONS OF SMALL INTESTINAL TISSUE UPON EXPERIMENTALLY-INOCULATED LYMPHOSARCOMA. Leslie R. Bennett, Frank E. Connon, and Melvin D. Schoenberg. Aug. 9, 1951. 14p. (UCLA-150)

The small-intestinal tissues of mice and rats have been fractionated in the ultracentrifuge at 90,000 g to yield a microsomal fraction which is inhibitory to Gardner lymphosarcoma and Sarcoma 180. Inhibition has been demonstrated by incubating tumor-cell suspensions with the centrifugal fractions previous to subcutaneous inoculation in CBA mice. Partial or complete inhibition of tumor development has been observed. Centrifugal fractions of spleen, liver, and muscle from the mouse have yielded no inhibitory effects against the tumors employed. (auth)

4948

Atomic Energy Project, Univ. of Calif., Los Angeles
QUANTITATIVE ESTIMATION OF ANTISPASMODIC POTENCY USING THE ISOLATED GUINEA PIG GALL BLADDER—COMMON DUCT PREPARATION. Thomas J. Haley and Murray Bassin. Aug. 22, 1951. 9p. (UCLA-151)

The isolated guinea pig gall bladder–common duct preparation is suitable for the evaluation of antispasmodic and antihistaminic activity. The log dose-response curve is linear over a wide range. The drugs studied are rated in the following order in counteracting or preventing acetylcholine spasm: atropine, Phenergan, diphenhydramine, Ambodryl, Thenfadil, C-5581-H, chlorocyclizine, chloroprophenpyridamine, and Anthallan. (auth)

4949

Atomic Energy Project, Univ. of Calif., Los Angeles
THE EFFECTS OF FOUR ANTIHEPARIN DYES ON THE ISOLATED HEARTS OF THE FROG, GUINEA PIG, AND RABBIT. James L. Leitch and Thomas J. Haley. Aug. 31, 1951. 9p. (UCLA-153)

The pharmacodynamic effects of Toluidine Blue, Azure A, Neutral Red, and Neutral Violet have been studied on the isolated hearts of the frog, guinea pig, and rabbit. These dyes have been shown to produce cholinergic blockade in the frog heart but not in the mammalian heart. The locus of action has been shown to be on the cell surface. The dyes were unable to block the negative inotropic effect of acetylcholine on the mammalian hearts. All the dyes had a direct cytotoxic effect on the mammalian hearts, and Neutral Red and Neutral Violet had a similar effect on the frog heart. (auth)

RADIATION EFFECTS

4950

Radiation Lab., Univ. of Calif.
BIOLOGICAL STUDIES OF RADIATION EFFECTS, p.41-72 of MEDICAL AND HEALTH PHYSICS QUARTERLY REPORT; JANUARY, FEBRUARY, AND MARCH, 1951. J. H. Lawrence. May 8, 1951. 15p. (AECD-3219(p.41-72))

A preliminary study of the effects of cyclotron irradiation of the pituitary gland of young male rats shows 30,000 rep has more effect on growth hormone and upon thyrotropic hormone production than on the production of ACTH and sex hormone. Using Fe^{59} tagged red blood cells it was shown that when 1 ml of homologous tagged blood is injected instantaneously intraperitoneally into rats, it is transferred from the peritoneum to the lymph at a rate such that 0.082% of what is present is moved per hour. The circulating blood receives each hour 0.41% of the tagged cells present in the lymph. The data do not indicate the presence of any mechanism for the transfer from the peritoneum cavity other than transfer to the lymphatic system and thence to the blood. A report is given of a study of the in vivo kinetics of iron turnover in the tissues of normal persons and in patients having various blood disorders, using intravenously

injected Fe^{59} tracer doses and a reliable high efficiency scintillation counter for external counting.

4951

Brookhaven National Lab.

EFFECTS OF CONTINUOUS GAMMA RADIATION ON CORN. W. Ralph Singleton. [nd] 2p. (AECU-1391)

The report is reproduced here in its entirety.

For the past two years corn plants have been grown in concentric circles around a 16-c source of Co^{60} placed in the center of a 3-acre field. The gamma rays from this source are similar to x rays except that the gamma radiation is harder (shorter wavelength) and more penetrating. The source is raised and lowered through a steel pipe into a lead "pig" in the ground by means of a remote control mechanism 70 m away. The source was in operation "up" for all of the time except when necessary to enter the field for cultivation, note taking, hand pollination, etc. The intensity of radiation is varied by the distance of the various rows from the source. Since the intensity of radiation is inversely proportional to the square of the distance from the source, extreme differences in radiation are obtained. For example plants at 1 m received 500 r/day while those at 10 m received only 5 r/day. At 60 m, only 0.084 r/day was received. The mutation rate of four endosperm characters su, pr, sh and r has been studied in both megaspore and microspore, mostly the latter because of the ease of obtaining larger numbers by applying pollen from the radiation field to plants in a clean field. In control plots it has been found that microspore mutation is much more frequent than in the megaspore. At the highest radiation given in 1950 (55 r/day) slightly more than 1 per cent of mutations were obtained from 6400 seeds studied. Lower intensities of radiation produced fewer mutations. No increase over the spontaneous mutation rate was found with intensities less than 5 r/day (the 10-m circle). A total of 275,000 seeds was examined in the whole program. Although endosperm characters were studied primarily there is no reason to suppose plant characters would not respond similarly to radiation. Attempts are being made to induce such plant characters as the short stalk rd, and the shorter stalk br_2. Pollinations made in the radiation field last year gave sufficient seed for about 10 acres of corn which is being examined for short types this year. If such plant types can be induced it seems likely that plant characters can be induced in an inbred line and detected within two or three years which is much less time than required by a crossing and backcrossing program. It is this feature of the gamma radiation that is of interest to plant breeders.

4952

Yale Univ. and Brookhaven National Lab.

INACTIVATION OF PEPSIN AND TRYPSIN BY DEUTERON AND ELECTRON BOMBARDMENT. Ernest Pollard, Anne Buzzell, Claire Jeffreys, and Frederick Forro, Jr. [nd] 17p. (AECU-1407)

The idea that ionizing radiation may be used as a means of measuring the size of genetic elements in biology is further investigated. The authors felt a better source of ionizing radiation than x radiation would be produced by deuterons, since the ionization is confined largely to a straight line with a spread of a few Angstrom units around that line, calculations of target size could be made very simply and the effect of ionization density could be studied. By bombarding pepsin and trypsin with deuterons and taking advantage of the straight-line distribution of ionization it was shown that a primary ionization anywhere in the molecule has a high probability of inactivating it. It was concluded that the bombardment of dry pepsin and trypsin by deuterons causes a logarithmic inactivation fitting with random passage through a definite target. With allowance for the efficiency of the deuteron beam the target size is in good agreement with that expected from the molecular weight. Electron bombardment of uncrystallized trypsin causes logarithmic inactivation fitting random inactivation in volume by primary ionization. This indicates that a single primary ionization in each molecule causes inactivation. If this proves to be general for enzymes it offers promise as an independent method of measuring molecular weight.

4953

Brookhaven National Lab.

THE RELATION OF NUCLEIC ACID METABOLISM TO THE GENETIC EFFECT OF RADIATION IN BACTERIA. (abstract) B. A. Rubin. [nd] 1p. (AECU-1436)

The report is reproduced here in its entirety.

Levels of continuous radiation (x rays or β rays) which rapidly kill resting bacteria (E. coli B/r) permit the growth of metabolizing organisms. When resting cells are inoculated into a fresh medium the inception of growth (lag) is delayed as a direct function of the radiation dose rate; but when multiplication begins, the rate of increase of cell mass during continuous radiation is equal to that in unirradiated controls and the same final culture densities are reached. Average cell size increases with the number of generations that have occurred during irradiation, but this accounts for only a fraction of the cell mass, the logarithmic increase in viable count makes up the rest. An examination of the mutant population (resistant to streptomycin) in cultures which have grown from 0 (resting) to 14 generations during irradiation indicates that the mutation rate is affected by the radiation dose, but not by the number of genetic reduplications during irradiation. Under the same conditions, changes in nucleic acid metabolism appear which are related to the extent of synthesis that has occurred during the irradiation.

4954

Brookhaven National Lab.

A CYTOLOGICAL AND CYTOCHEMICAL APPROACH TO AN UNDERSTANDING OF RADIATION DAMAGE IN DIVIDING CELLS. A. H. Sparrow, M. J. Moses, and R. Steele. [nd] 17p. (AECU-1438)

The amount of chromosome fragmentation induced by a dosage of 50 r of x radiation has been determined at various stages in the meiotic nuclear cycle of Trillium erectum. Diplotene seems to be the most sensitive, and early interphase least sensitive. (Diakinesis and first metaphase are also highly sensitive.) The sensitivity change is at least 60-fold. Higher rejoining is apparently a significant factor in reducing the amount of definitive fragmentation at the least sensitive stage, but does not account for the whole difference in sensitivity. Desoxypentose (DNA) and pentose (PNA) nucleic acid determinations show that the DNA per pollen-mother-cell increases up to diplotene and remains constant thereafter until early post-meiotic interphase. Synthesis starts again during later interphase. PNA remains constant from pachytene through second division to early interphase. The sharp rise in the sensitivity curve during the periods when DNA content increases indicates that increasing sensitivity may be associated with synthesis of DNA. However, the fall in breakage sensitivity between first metaphase and early post-meiotic interphase when DNA content does not change indicates that DNA content does not determine cellular radiosensitivity. (auth)

4955

Cancer Research Inst., New England Deaconess Hospital, Boston

SOME ACUTE CYTOLOGIC EFFECTS OF IONIZING RADIATION. Shields Warren, Margaret W. Holt, Sheldon C. Sommers. [nd] 10p. (AECU-1443)

Frozen-dried, dry mounted Feulgen-stained preparations of irradiated rat and mouse tissues were employed to study acute cytologic changes after ionizing radiation. Fine nuclear details are preserved by the freezing-drying method. Lethal radiation effects observed in radiosensitive cells include formation of large intranuclear vacuoles with stretching of nuclear membranes. Nonlethal changes in radioresistant tissues comprise smaller intranuclear vacuoles, decreased Feulgen stain of nuclear chromatin and sap, and loss of regular sharp staining of nuclear membranes. Such changes in liver cells may contribute to the acute radiation syndrome. Histochemical techniques may provide a better understanding of tissue changes after ionizing radiation. (auth)

4956

Delaware Univ. and Marine Biological Lab., Woods Hole, Mass.

RADIOSENSIVITY OF HAPLOID AND DIPLOID HABROBRACON DURING PUPAL DEVELOPMENT. A. M. Clark and C. J. Mitchell. [nd]. 15p. (AECU-1444)

Haploids and diploids of the parasitic wasp Habrobracon were exposed to x rays during various stages of pupal development in order to test for differential radiosensitivity. The ability to emerge from the cocoon was taken as the criterion of viability. Dosage-eclosion curves show that diploids are more resistant than haploids at all stages of pupal development. During the earlier stages, diploids are about three times as radioresistant as haploids, while during the later stages the differential radiosensitivity is not as great. Resistance increases with age. For haploid pupae the increase in resistance is exponential with age. Younger diploid pupae increase in resistance at a rate identical with the haploids, but older diploid pupae do not increase in resistance as rapidly. The deleterious action of radiation on somatic tissues is interpreted to be due to injury to the genetic mechanism. (auth)

4957

Brookhaven National Lab.

EFFECT OF CONTINUOUS GAMMA RADIATION ON MUTATION RATE IN MAIZE. (abstract) W. R. Singleton. [nd] 1p. (AECU-1461)

The report is reproduced here in its entirety.

Continuous gamma radiation from Co^{60} was used in studying the mutations induced in maize pollen. The intensity varied from 125 to 0.09 r/day. Four endosperm characters were studied: R, Pr, Su, and Sh. Pollen from the dominant stock A,B Pl C R Pr Su Sh growing in the radiation field was placed on silks of a multiple recessive a b pl c r pr su sh growing in a field with only background radiation. The following results were obtained: (1) There was no increase in mutation rate over the control when the radiation was less than 5 r/day. (2) Above 5 r/day there was a gradual increase up to 31 r/day with a more marked increase from 31 to 55 r/day. From 55 to 125 r/day the increase in mutations was even more marked. The increase in mutation rate at the higher intensities of radiation was greater than expected if the increase is linearly proportional to dose. (3) The logarithm of the mutation rate seemed to show a linear relationship with dose received. (4) The gene with the greatest spontaneous mutation frequency (R) showed a smaller increase in induced changes than the other three genes Su, Sh, and Pr. (5) In control plots the mutations detected in the microspore were appreciably higher than those found in the megaspore. This is expected since only those mutations that occur at or before the first mitotic division of the megaspore mother cell will be detected because of the triple fusion forming the endosperm.

4958

Brookhaven National Lab.

THE EFFECT OF CONTINUOUS GAMMA RADIATION UPON STARCH FORMATION IN ZEA MAYS POLLEN. (abstract) M. L. Koester. [nd] 1p. (AECU-1463)

The report is reproduced here in its entirety.

Mature pollen from corn plants was tested with 0.2 per cent solution of iodine potassium iodide to determine those grains which were not completely filled with starch and for this study classed as abnormal. Plants used in this experiment received from 0.09 to 222.2 r per day throughout the growing season. A relationship was found between dosage received and percentage of abnormal pollen produced. Pollen from plants which received dosages up to 1.3 r per day showed no increase over the control in the percentage abnormal, but for dosages above 2.6 r per day there was observed a gradual increase in the percentage of abnormal pollen grains. The highest dosage studied gave the greatest percentage of abnormal pollen, 57.0 per cent. When the log of the dose was plotted against the percentage of abnormal pollen, the data were shown to fit a portion of a sigmoid curve.

4959

Brookhaven National Lab. and New York Univ.

EFFECTS OF DIRECT CATHODE RAY PARTICLE IRRADIATION OF THE HYPOPHYSIS AND WHOLE BODY X-IRRADIATION ON THE ADRENOCORTICOTROPHIN, GONADOTROPHINS, AND THYROTROPHIN OF THE PITUITARY GLAND OF THE RAT. (abstract) G. M. Mateyko, A. Edelmann, H. A. Charipper, and A. S. Gordon. [nd] 1p. (AECU-1513)

The report is reproduced here in its entirety.

Cathode ray particle irradiation (I- Van de Graaff; 2.23×10^{-3} μ a sec) confined to the volume of the pituitary gland, or whole body x-irradiation (II- 250 kvp, 30 ma, 0.25 mm Cu, 1.0 mm Al; 1,000 r) was given to rats and the adrenocorticotrophic, gonadotrophic, and thyrotrophic titers of the hypophyses were determined by bioassays at 1, 6, and 24 hr after exposure. Following I, the adrenocorticotrophin was elevated at 1 hr and remained at high levels 6 and 24 hr post irradiation. Following II, there was a similar rise at 1 hr, the level starting to fall by 6 hr, and declining to subnormal values within 24 hr. In both groups the gonadotrophins had fallen by 1 hr and remained at subnormal titers throughout the 24 hr period. Following I, the level of thyrotrophin was elevated at 1 and 6 hr, and fell below normal in 24 hr. A similar, but less marked response, was observed after II. The data suggest that the noxious stimuli of radiation cause an acceleration of adrenocorticotrophic synthesis initially at the expense of the gonadotrophins, and ultimately, of the thyrotrophin. A response was obtained on animals receiving whole body x-irradiation but with their heads shielded. This might indicate an "indirect" effect on the pituitary as contrasted to "direct" effects as seen after I.

4960

Argonne National Lab.

EFFECT OF CYSTEINE ON THE RADIOSENSITIVITY OF THYMIC CELLS IN VITRO. R. L. Straube, George Svihla, M. E. Blackford, and H. M. Patt. July 1951. 1p. (AECU-1532; UAC-407)

The report is reproduced here in its entirety.

The effect of cysteine on the radiosensitivity of thymic cells incubated in vitro has been studied cinemaphotographically. Normal thymic cultures and cultures to which cystine has been added, as well as irradiated cultures, are shown for comparison, both immediately and 20 to 24 hr following preparation. Cysteine (0.02M) does not alter the activity of normal cells. Motility, protoplasmic streaming, pseudopod extension, nuclear granularization, and vacuolization occur to the same degree in both preparations. Loss of motility and rounding up of the cells to form indistinctly granular spheres, with occasional nuclear vacuolization, is

usually preceded by a flurry of activity. Such spherical, quiescent cells stain with eosin or safranin. More quiescent cells are found after incubation for 20 to 24 hr in all preparations. Since the mature thymic cells almost never divide, population reduction due to cellular senescence and death is a constant factor. Irradiation of a thymic suspension with 1000 r greatly reduces the number of cells surviving at 20 to 24 hr. The majority of surviving cells, unlike those in the cystine 1000-r series, are nonmotile. Thus, on a qualitative basis, control cells and cells to which cystine has been added are essentially similar at both 0 and 24 hr. Control irradiated cells and cystine irradiated cells are similar at 0 hr, but at 24 hr preparations of the latter contain almost as many motile forms as the normal, whereas those of the former show predominantly quiescent forms. (auth)

4961

Chicago Univ.

THE ROLE OF INFECTION IN RADIATION INJURY. C. Phillip Miller, Carolyn W. Hammond, and Marianne Tompkins. [nd] 27p. (AECU-1543)

Male white mice averaging 20 g in weight were subjected to 600 or 450 r total-body x radiation in a single exposure. In the 600 r series, 288 mice were killed and cultured (at the rate of 20 a day). Of these, 113 showed positive cultures from heart's blood and/or spleen. Eighty per cent of the positive cultures occurred during the 2nd week postirradiation, the period of greatest mortality. In the 450-r series, 595 mice were killed and cultured (at the rate of 35 a day). One hundred fifty-two showed positive cultures from heart's blood and/or spleen. Sixty-six per cent of the positive cultures occurred during the 2nd week postirradiation. In a majority of the animals the bacteremia was severe enough to be regarded as an overwhelming sepsis. The bacteremia was caused by microorganisms normally present in the lower bowel of this strain of mice. Control cultures on unirradiated mice were all sterile. It is concluded that septicemia caused by microorganisms of enteric origin is in large measure responsible for the death in mice irradiated with these doses of x ray. (auth)

4962

Argonne National Lab.

PLANNED CONTROLS OF EXPERIMENTAL CONDITIONS IN THE NEUTRON TOXICITY PROGRAM AT ARGONNE NATIONAL LABORATORY. Howard H. Vogel, Jr. July 1951. 1p. (AECU-1555; UAC-413)

The report is reproduced here in its entirety.

Preliminary experiments planned for the neutron program have been devised to test the radiobiological additivity of fast neutrons and γ rays in their acute lethal action on mice. It is planned to test the additivity of these two radiations at three different dose rates. Nine survival curves will be obtained: one for fast neutrons, one for γ rays, and one for the two radiations combined in approximately equal radiobiological intensity. The results of these experiments should have both theoretical and practical significance in our understanding of the biological effects of ionizing radiations.

Complete data are lacking on the extent to which transportation affects longevity in animals. Since animals will be carried a distance of approximately 5 miles to the irradiation sources, careful consideration has been given to the control of the environmental conditions during transit A 1-ton panel truck has been modified so that the space back of the driver's seat is well insulated, and the truck is air conditioned so that temperature can be maintained throughout the year at 74° ± 4°F. Humidity can also be controlled. By a system of thermostats and relays the heating and cooling systems can be run when the truck is in operation (8-v circuit off the truck's battery) or when the truck is standing (by plugging in to any convenient 110-v outlet).

A new experimental animal building has been constructed to house mammals that will be irradiated at a nearby reactor. Details of the controlled environment in this building will be discussed.

4963

Argonne National Lab.

THE EFFECT OF X RAYS ON THYMOCYTES AND ITS MODIFICATION BY CHEMICAL MEANS. (abstract) H. M. Patt, M. E. Blackford, R. L. Straube, and D. E. Smith. July 1951. 1p. (AECU-1557; UAC-409)

The report is reproduced here in its entirety.

X radiation decreases the life span of rabbit thymocytes in vitro, the percentage of surviving cells (eosin resistant) decreasing exponentially with increasing radiation dosage. The LD_{50} at 24 hr is 150 r and definite effects appear with 50 r. Sensitivity is decreased by a factor of 2 over the range of 50 to 1500 r when cysteine (0.02M) is added to the cell suspension before irradiation. The small reduction in toxicity which occurs when cysteine is added after exposure may be due in part to persistence of a toxic substance in the medium, as well as to reversal of a chain of radiation action, since irradiation of only the medium (serum-phosphate buffer) is slightly toxic to cells added subsequently. Anoxic anoxia and cysteine afford comparable protection to thymocytes irradiated with 200 r but they are not additive under these conditions. Packed cells are less radiosensitive than cells suspended in serum and are not protected by cysteine or anoxia. This may be attributed perhaps to the fact that packed cells are already anoxic, since cells exposed to oxygen before centrifugation are as sensitive as cells in suspension. These findings suggest that at least two mechanisms are concerned in the cytocidal action of x rays, one of which is subject to the influence of cysteine and anoxia. It is assumed that these factors act on toxic chemical intermediates that are formed during irradiation, though not necessarily in the same manner. A specific metabolic action cannot yet be ruled out, however.

4964

Los Alamos Scientific Lab.

THE USE OF X-RAY AND NITROGEN MUSTARD TO DETERMINE THE MITOTIC AND INTERMITOTIC TIMES IN NORMAL AND MALIGNANT RAT TISSUES. William R. Widner, John B. Storer, and C. C. Lushbaugh. [nd] 31p. (AECU-1567)

An indirect method for determining the length of time required for completion of mitosis after arrest by x irradiation has been extended to normal and malignant rat tissues from experiments previously done on mice (Knowlton and Widner, Cancer Research 10, 59(1950)). An attempt was made to substitute nitrogen mustard (methyl bis(β-chloroethyl)amine HCl) for x radiation in the method, but this was unsuccessful because of apparent differences in the mode of action of the two agents. The intermitotic times or length of the resting stage of various tissues are compared. The concept of rate of cellular proliferation has been more accurately defined than formerly by this study. The importance of the determinations of the length of the cellular resting stage in studies of growth and tumor chemotherapy is discussed. (auth)

4965

Institute of Radiobiology and Biophysics, Univ. of Chicago and Argonne National Lab.

EXPONENTIAL AND SIGMOID SURVIVAL CURVES RESULTING FROM ALPHA AND X IRRADIATION OF ASPERGILLUS SPORES. Raymond E. Zirkle, Dorothy F. Marchbank, and Kathryn D. Kuck. Mar. 1951. 14p. (ANL-4610)

After samples of air-dry spores of Aspergillus terreus fungi had been given graded doses of polonium α particles and of 200-kv x rays, survival fractions were determined, the criterion of a surviving spore being the formation of a germ tube. When survival fraction was plotted against dose, the α-ray curves were exponential, but the x-ray curves were sigmoid, and the experimental points could be fitted fairly well by "two-hit" theoretical curves. It is concluded that, in this particular radiobiological action, the number of entities which must be altered in each cell is quite small, and that, whereas all of them (one or more) are altered by one suitably located α track, two (possibly more) electron tracks are required to produce the same alteration(s). The results also indicate that the decisive events of the radiobiological action occur very early, i.e., before each relevant ionization track loses its original configuration by diffusion of the initially activated molecules or their chemical derivatives. (auth)

4966

Brookhaven National Lab.

BIOLOGY DEPARTMENT, p.86-93 of QUARTERLY PROGRESS REPORT; JANUARY 1–MARCH 31, 1951. June 1951. 7p. (BNL-103(p.86-93))

Corn was grown in the 16-c Co^{60} γ field at varying distances from the source in order to study the effect of continuous γ irradiation on the mutation rate. Four genes in pollen of maize receiving a dose of 1.25 to 1850 r during the sensitive period showed no increase in mutation rate above the spontaneous rate at doses less than 5 r/day or 70 r for a 2-week period. The four genes react differently. The mutation rate curves are not straight lines. Experiments with whole-body x-irradiated hypophysectomized rats indicate that the pituitary gland is primarily responsible for the initial period of diuresis; LD_{50} dose is about 650 r compared to 1000 r for normal animals. Measurements of the hormone content of the pituitary gland after x radiation show great direct sensitivity of the gland; its economy seems to direct ACTH formation at the expense of other hormones. Castrated rats show no difference in their reaction to x rays as compared to normal animals. O_2 uptake of duck erythrocytes measured in vitro decreases following whole-body x irradiation. C^{14}-labeled periston (polyvinyl pyrrolidone) was injected into mice in order to test the material as a blood-plasma substitute. Low-viscosity periston was excreted more rapidly than the higher viscosity material, and analysis of the tissues showed highest specific activity in skin and hair (see also p.97 of this report). Experiments are in progress testing the effects of different concentrations of dinitrophenol on the phosphate metabolism of rat diaphragm.

4967

Atomic Energy Project, Western Reserve Univ.

MONTHLY PROGRESS REPORT MARCH 1951. Hymer L. Friedell. May 6, 1951. 8p. (NYO-1629)

Very brief status reports of studies on the synergistic effect of X and P^{32} or Au^{199} radiations on mortality, significance of initial radiation dose on rat leukocyte depression, reduced lethality of P^{32} in divided doses, effect of in vivo dialysis of blood on survival of x-irradiated dogs, and protective effect of propylene glycol, glycerin, and cysteine against radiation. Results are reported only qualitatively. Other current projects are listed.

4968

Oak Ridge National Lab.

CHANGES IN COMPOSITION OF BLOOD PLASMA OF THE RAT DURING ACUTE RADIATION SYNDROME, AND THEIR PARTIAL MITIGATION BY DIBENAMINE AND CORTIN. Henry I. Kohn. June 12, 1951. 54p. (ORNL-387)

Adult rats were given a single total-body exposure to 250 kvp x rays, and the changes in the plasma followed for about 30 days. Potential sources of error due to the technic of blood sampling or to changes in appetite were controlled. The changes in the plasma occurred in 2 phases, unaffected by sex but somewhat dependent upon the strain of rat. The magnitude of the changes varied with the x-ray dosage (125 r, 350 r, 650 r), but the timing and sequence did not. The first phase (day 0 to 3) was characterized by a temporary rise in glucose, nonprotein nitrogen (NPN), and phosphorus levels; the second (days 3 to 10) by a rise in plasma chloride (approximately balanced by a drop in erythrocyte chloride) and cholesterol. A fall in total protein and an elevation in the albumin/globulin ratio began in the first phase but, since their duration was dependent upon dosage, at the higher levels they continued into the second phase. Phospholipid was unchanged. The changes in chloride and cholesterol were prevented by the daily administration of desoxycorticosterone acetate or lipoadrenal extract. Dibenamine, or its hydroxy congener, prevented the change in cholesterol. Injection of foreign protein (sheep erythrocytes) 1 week before irradiation prevented the rise in albumin/globulin ratio.

4969

Oak Ridge National Lab.

X-RAY SENSITIVITY OF E. COLI AS MODIFIED BY OXYGEN TENSION. Alexander Hollaender, G. E. Stapleton, and F. L. Martin. June 4, 1951. 13p. (ORNL-832)

The influence of oxygen tension on sensitivity of E. coli to x-irradiation damage and the influence of cultural conditions to sensitivity were studied. It was shown that lowering the O tension of bacterial suspensions results in a striking decrease of radiósensitivity of the cells, as compared with O-generated suspensions. The order as well as the slope of the survival curves is different under low and high O tension. To set apart radiation effects produced through the intermediate aqueous suspension and those concerned with the bacterial cell as such, various culture conditions were studied which might alter recognizable effects on the cell. Results emphasize the importance of O tension, state of oxidation or reduction inside the organisms during exposure to x irradiation and the possible modifying effect of the type of metabolism carried out by the organism before irradiation. Most of the data are consistent with the idea that radiodecomposition products of water are contributing toxic agents, e.g., H, OH, HO_2, H_2O_2, some of which are produced only in the presence of O irradiation. However, it is thought that not all the findings in regard to O concentration can be explained on this basis.

4970

Columbia Univ.

BIOLOGICAL EFFECTS OF RADIATION, paper 6 of HEALTH PHYSICS INSURANCE SEMINAR; [FEBRUARY 6–10, 1950]. G. Failla. Mar. 12, 1951. 5p. (TID-388(paper 6))

A brief, general discussion of the nature of the roentgen (r) unit, the relative biological effects of various radiations, and the possibilities of radiation-produced cancer, cataracts, and leukemia is presented.

4971

Atomic Energy Project, Univ. of Rochester

THE ROLE OF AN ANTIBIOTIC-PRODUCING ORGANISM IN THE SMALL INTESTINE. James Vincent and Robert Veomett. June 21, 1951. 34p. (UCLA-142)

A gram-negative, highly pleomorphic organism, which may be related to the lactobacilli and which has been found to produce an antibiotic-like substance in vitro, was discovered to be the predominant organism in the small intestinal flora of mature Wistar rats from two sources. A filterable form of the indigenous pleomorphic bacillus was

found to occur in the small intestine and was recovered consistently, although in small numbers, from the blood and organs of normal rats. The small-intestinal flora of rats from the two sources showed marked generic similarity but showed strain and species differences. An invasion of the small intestine by gram-negative bacilli with a concomitant bacteremia has been found to parallel the appearance of marked external irradiation symptoms in rats receiving 650-r (LD_{90} 30-day) doses of x irradiation. A negative correlation has been noted between the severity of the external irradiation symptoms and the number of pleomorphic bacteria present in the small intestine. Those rats which retained high counts of the indigenous pleomorphic bacillus showed little evidence of postirradiation infection. Gram-negative invasion occurred only when there was a drop in the pleomorphic count.

4972

Atomic Energy Project, Univ. of Calif., Los Angeles

THE INFLUENCE OF ANOXIA UPON DESTRUCTION AND MITOSIS OF THE HEMATOPOIETIC CELLS OF X-IRRADIATED TADPOLES. Bennet M. Allen, Ole Arne Schjeide, and Ronald Piccirillo. Aug. 14, 1951. 13p. (UCLA-149)

The influence of anoxia on the initial (24-hr) effect of 500 r of x irradiation of 10 μy of colchicine upon the hematopoietic cells of tadpoles of the bullfrog, Rana catesbiana, has been determined. Anoxia markedly reduces the cell destruction resulting from the x irradiation and in like percentage reduces the colchicine effect—pycnosis and arrested mitosis—during this period. Anoxia applied after either of these treatments gave almost as great a "protection" against these effects. It is probable that this "protection" observed at the end of 24 hr is wholly or in part to be interpreted as a delay of mitosis. Four equally spaced 1-hr exposures to anoxia proved much more effective than two, but there was marked destruction in spite of either amount of anoxia. The closely comparable degree of "protective" effect of anoxia upon both the x-irradiated and colchicine-treated groups and the fact that colchicine is an inhibitor of mitosis add further support to the view that destruction of hematopoietic cells takes place at or near mitosis.

4973

Atomic Energy Project, Univ. of Rochester

PATHOLOGY IN ANIMALS SUBJECTED TO REPEATED DAILY EXPOSURE TO ROENTGEN RAYS. Roger G. Metcalf and Frank A. Inda. July 5, 1951. 59p. (UR-88)

Detailed observations and conclusions are presented on tissue injuries observed in rats exposed to 0.1, 0.5, 1.0, or 10 r/day of x irradiation for 2 yr, in rabbits exposed to the same daily doses for 1 yr, and in dogs exposed to 0.1, 0.5, 1.0, 3.0, 6.0, and 10.0 r for either 500 or 622 days. In rats, the testes are severely injured with administration of 10 r/day, but not specifically injured at 0.1, 0.5, or 1.0 r/day. There is evidence to suggest that the incidence of leukemia in all treated rats and mammary fibroadenomata in females is increased by chronic x radiation. There is no histologic evidence of x-radiation injury in other organs. The histologic changes are not influenced by the voltage used in this experiment. In rabbits, the only consistent lesion attributable to x radiation is testicular injury in the 10-r/day groups. Injury to testes, appearance of bone marrow hypoplasia, decrease of megakaryocytes, focal bowel hemorrhages, and lymph node hemorrhage in the dogs are related to the chronic x irradiation. 19 figures.

4974

Rochester Univ.

POSSIBLE LATE TUMOR DEVELOPMENT IN RAT EMBRYOS IRRADIATED WITH 100 r OF X-RADIATION ON THE 9TH DAY OF GESTATION. Robert L. Brent and H. Charles Jordan. Jan. 19, 1951. 1p. (UR-150)

The report is reproduced here in its entirety.

Rat embryos were isolated in utero and given 100 r of x radiation. In one series sacrificed at intervals up to and including 15 days gestation, groups of tumor cells apparently originating from neural tissue were observed in the cephalic portion. These tumors vary in size, differentiation, and position; some are associated with brain tissue, others with the skin, and many are distributed in the intervening mesenchymal tissue.

A second series of embryos were subjected to the same procedure and sacrificed at intervals from 15 days gestation until term. Gross observations have revealed tissue masses of such size as to prevent closure of the midsagittal suture. The largest of these growths were observed at 15, 16, and 17 days, while growths observed at term are uniformly smaller. This apparent failure of embryos bearing the larger growths to survive may account for the sharply increased incidence of resorption seen at term as compared with 16 days. Histologic studies are in progress to determine whether these masses are identical with the above-mentioned types of tumor or are distortions of the brain wall.

4975

Rochester Univ.

NEOPLASTIC GROWTHS INDUCED BY X-IRRADIATION IN EMBRYONIC RATS. J. G. Wilson. Jan. 22, 1951. 1p. (UR-153)

The report is reproduced here in its entirety.

Rat embryos in the 9th day of gestation were irradiated directly through an abdominal incision in the mother. Lead plates were so arranged that only selected implantation sites were exposed while the mother and remaining sites were shielded. After post-irradiation intervals of 1 to 6 days the embryos were removed and prepared for histologic study.

Abnormal growths consisting of compact masses of epithelioid cells appeared in the mesenchyme surrounding the developing brain within 2 days after exposure to x rays. Following an initial spurt of growth, some of these masses dispersed and were no longer recognizable, others remained compact but showed little further growth, and still others continued to grow rapidly, resulting usually in prenatal death of the embryo. Growth of the tumors beyond a minimal size appeared to be dependent upon the abundance of blood supply in the vicinity.

These embryonic neoplasms are believed to have arisen from certain cells within the neural primordium that were altered by the irradiation. This is supported by the following observations: (1) the occasional retention of a connection with the neural tube, (2) their histologic resemblance to contemporary tissues within the neural tube, and (3) a tendency to differentiate toward definitive neural elements.

The incidence of tumors, both number of animals affected and number of growths per animal, increased directly as the dosage increased from 25 to 200 r.

4976

Atomic Energy Project, Univ. of Rochester

A NOTE ON THE SYNTHESIS OF FATTY ACIDS IN BONE MARROW HOMOGENATES AS AFFECTED BY X-RADIATION. K. Altman, J. Richmond, and K. Salomon. May 17, 1951. 12p. (UR-169)

The synthesis of saturated and unsaturated fatty acids in bone marrow homogenates from untreated and x-irradiated rabbits has been studied with α-C^{14}-acetate as a precursor. Two- and three-fold increases, respectively, over pre-irradiation levels in saturated and unsaturated fatty acid synthesis were observed immediately after irradiation. Whereas saturated fatty acid synthesis, which approached control values at 48 hr after irradiation, again increased

3½ times at 72 hr, unsaturated fatty acid synthesis had fallen to 18% of the preirradiation value. At 158 hr the relationship was reversed since unsaturated fatty acid synthesis had risen to 283% and saturated fatty acid synthesis had dropped to 58% of the preirradiation value. Oxygen uptake and $C^{14}O_2$ production increased immediately after irradiation, dropping to preirradiation values 48 hr after exposure. $C^{14}O_2$ evolution decreased steadily throughout the experimental period while oxygen uptake was unchanged 158 hr after exposure. (auth)

4977

Army Inst. of Pathology

MEDICAL EFFECTS OF ATOMIC BOMBS; THE REPORT OF THE JOINT COMMISSION FOR THE INVESTIGATION OF THE EFFECTS OF THE ATOMIC BOMB IN JAPAN; VOLUME 1. Ashley W. Oughterson, George V. LeRoy, Averill A. Liebow, E. Cuyler Hammond, Henry L. Barnett, Jack D. Rosenbaum and B. Aubrey Schneider. Apr. 19, 1951. 246p. (NP-3036; AM-2837(vol.I))

The first of five unclassified volumes (NP-3036 through NP-3040) first reproduces the original orders establishing the Joint Commission, lists the personnel, and gives original data on the mean and differential leukocyte counts of residents of Nagasaki not directly exposed to the atomic explosion but perhaps exposed to residual radioactivity. Copiously illustrated descriptions of the terrain, buildings, populace, and of the raids of Aug. 6 and 9, 1945, and their immediate effects on Hiroshima and Nagasaki are followed by eyewitness accounts of the atomic bomb explosions and of their consequences. 64 figures. 2 maps.

4978

Army Inst. of Pathology

MEDICAL EFFECTS OF ATOMIC BOMBS; THE REPORT OF THE JOINT COMMISSION FOR THE INVESTIGATION OF THE EFFECTS OF THE ATOMIC BOMB IN JAPAN; VOLUME II. Ashley W. Oughterson, George V. LeRoy, Averill A. Liebow, E. Cuyler Hammond, Henry L. Barnett, Jack D. Rosenbaum, and B. Aubrey Schneider. [nd] 345p. (NP-3037; AM-2837(vol.II))

Clinical records and specimens taken by Japanese physicians following the raids on Hiroshima and Nagasaki and later collected by the Joint Commission are reviewed, and résumés of original Japanese reports are given. Clinical observations on the etiologic factors and consequences of injury by blast, heat, and ionizing radiation are reported in detail. Photographs of damage to structures, "shadow" effects, and selective destruction of clothing, etc., by heat are shown in addition to those of clinical interest. 129 figures.

4979

Army Inst. of Pathology

MEDICAL EFFECTS OF ATOMIC BOMBS; THE REPORT OF THE JOINT COMMISSION FOR THE INVESTIGATION OF THE EFFECTS OF THE ATOMIC BOMB IN JAPAN; VOLUME III. Ashley W. Oughterson, George V. LeRoy, Averill A. Liebow, E. Cuyler Hammond, Henry L. Barnett, Jack D. Rosenbaum, B. Aubrey Schneider. [nd] 212p. (NP-3038; AM-2837 (vol.III))

The studies made by Japanese sources and by the Joint Commission on the changes in peripheral blood, blood-clotting mechanism, and bone marrow of patients with radiation injury resulting from the atomic bomb explosions over Hiroshima and Nagasaki are reported in detail.

4980

Army Inst. of Pathology

MEDICAL EFFECTS OF ATOMIC BOMBS; THE REPORT OF THE JOINT COMMISSION FOR THE INVESTIGATION OF THE EFFECTS OF THE ATOMIC BOMB IN JAPAN; VOLUME IV. Ashley W. Oughterson, George V. LeRoy, Averill A. Liebow, E. Cuyler Hammond, Henry L. Barnett, Jack D. Rosenbaum, and B. Aubrey Schneider. [nd] 324p. (NP-3039; AM-2837(vol.IV))

The present volume is devoted to the pathology observed in material obtained at autopsy of victims of the atomic bomb explosions over Hiroshima and Nagasaki. Particular attention is paid to the effects of ionizing radiation. Systematic organ-by-organ descriptions are given, with a statistical account of the material available and of the changes observed. 193 figures.

4981

Army Inst. of Pathology

MEDICAL EFFECTS OF ATOMIC BOMBS; THE REPORT OF THE JOINT COMMISSION FOR THE INVESTIGATION OF THE EFFECTS OF THE ATOMIC BOMB IN JAPAN; VOLUME V. Ashley W. Oughterson, George V. LeRoy, Averill A. Liebow, E. Cuyler Hammond, Henry L. Barnett, Jack D. Rosenbaum, and B. Aubrey Schneider. [nd] 343p. (NP-3040; AM-2837(vol.V))

A detailed statistical analysis is presented of the medical history of 6882 individuals in Hiroshima and 6621 in Nagasaki known to be alive 20 days after the atomic bombings. Burns, mechanical injuries, blast effects, radiation symptoms, hematology, and deaths are related to distance, shielding, age, sex, etc.

RADIATION HAZARDS AND PROTECTION

4982

Worthington Pump and Machinery Corp.

DESIGNING VENTILATION AND AIR-CONDITIONING FOR SAFETY IN AN ATOMIC ENERGY RESEARCH PROJECT. Richard E. Holmes. Apr. 1951. 28p. (AECU-1432; UAC-384)

Ventilation principles in an atomic energy project, ventilated bench hoods, ventilated dry boxes, caves, filter systems, and hood air-velocity control problems are discussed in a general and nontechnical manner. 10 figures.

4983

Brookhaven National Lab.

INSTRUMENTATION AND HEALTH PHYSICS DEPARTMENT, p.47-52 of QUARTERLY PROGRESS REPORT; JANUARY 1–MARCH 31, 1951. June 1951. 6p. (BNL-103(p.47.52))

Projects described as in progress in the Electronics Division include the following: A convenient activation method of recording flux distribution with Cu wire; a scintillation counter to record γ rays from I^{131} in blood samples placed in a 1-cc cup on top of a NaI(Tl) crystal mounted on a photomultiplier; waterproofing and testing of an ionization chamber and electrometer tube for submersion in the reactor canal; and design of a d-c-operated logarithmic electrometer circuit making use of a 571 AX tube as the logarithmic diode and another as the electrometer tube. Power supplies for various purposes and a radiological monitoring truck were constructed, and work was done to make different type timing circuits possible.

4984

Hanford Works

FILTRATION OF RADIOACTIVE AEROSOLS BY GLASS FIBERS; PART ONE. A. G. Blasewitz, R. V. Carlisle, B. F. Judson, M. F. Katzer, E. F. Kurtz, W. C. Schmidt, and B. Weidenbaum. Apr. 16, 1951. 126p. (HW-20847 (pt.1))

The disposal of radioactive waste gases from the plant-scale processes at the Hanford Works presents a problem that is of considerable importance in plant operation. This report is concerned with the intensive removal of the particulate matter suspended in the gas streams. In order to develop a filter unit having better performance character-

istics than those of the presently employed sand filters, an extensive investigation of the filtration properties of glass fibers was undertaken. The program was divided into four portions consisting of (1) a study of the physical characteristics of glass fibers; (2) the determination of the size distribution and concentration of the particulate matter suspended in the gas streams at Hanford; (3) the correlation of pressure drop and collection efficiency under start-up conditions with superficial air velocity, the bed depth, and the packing density of the various types of glass fibers; and (4) a study of the expected service life of glass-fiber filters. The results of the development program led to the design of glass-fiber filters capable of operating at a higher superficial air velocity than the plant sand filters and with a greater efficiency, a lower flow resistance, and a greater life expectancy. Illustrations and operating characteristics are given for the developed filters. (auth)

4985
Illinois Univ. Engineering Experiment Station
THE IMPACTION OF AEROSOL PARTICLES ON CYLINDRICAL AND SPHERICAL COLLECTORS. (Technical Report No. 3) W. E. Ranz. Mar. 31, 1951. 92p. (SO-1004)

The impaction of small particles on cylindrical and spherical collectors has been analyzed in terms of the forces which affect the motion of a particle and cause it to move from an aerosol stream onto a collecting surface. Dimensionless parameters which characterize the various mechanisms of collection are defined for inertial separation, interception, electrical attraction by charges, electrical attraction by induction, settling, and random molecular motion. Significant values of the parameters have been determined. The various theories of impaction of aerosol particles on simple collectors have been investigated and extended to a comprehensive statement of the general problem of impaction efficiencies. Practical applications to dust- and smoke-removal systems are indicated. An appendix to this report contains English translations of two important references on the filtration of dust and smoke from air streams, viz., Albrecht, "Theoretical Investigation of Dust Deposition from Flowing Air and Its Application to the Theory of the Dust Filter," Physik. Z. 32, 48-56(1931); and Sell, "Dust Precipitation on Simple Bodies and in Air Filters," Forsch. Gebiete Ingenieurw. 2, Forschungsheft 347(1931) Aug.

4986
Atomic Energy Commission
HEALTH PHYSICS INSURANCE SEMINAR; [FEBRUARY 6-10, 1950]. K. Z. Morgan, E. Pollard, F. P. Cowan, J. B. H. Kuper, D. Balber, N. H. Woodruff, P. C. Aebersold, G. Failla, M. Eisenbud, H. Blatz, and G. W. Morgan. Mar. 12, 1951. 161p. (TID-388)

Separate abstracts have been prepared on the following sections of this report: Historical Sketch of Radiation-protection Experience and Survey of Existing Problems, paper 1; The Present and Future Use of Radioactive Isotopes, paper 2; Summary of Pertinent Atomic and Nuclear Physics, paper 3; Units of Radioactivity and Radiation, paper 4; Quantitative Summary of Natural, X-ray, and Other Common Radiation Levels, paper 5; Biological Effects of Radiation, paper 6; Maximum Permissible Exposure of Personnel, paper 7; Health Physics Instruments, paper 8; Monitoring and Protection Techniques. I, paper 9; Instrument Evaluation and Air Sampling, paper 10; Monitoring and Protection Techniques. II, paper 11; Safe Practices in Handling Isotopes, paper 12; Design of Small-scale Radiochemical Laboratories, paper 13; Decontamination and Waste Disposal, paper 14; and Controls Exercised by the Atomic Energy Commission in Distribution of Radioactive Isotopes, paper 15.

4987
Oak Ridge National Lab.
HISTORICAL SKETCH OF RADIATION-PROTECTION EXPERIENCE AND SURVEY OF EXISTING PROBLEMS, paper 1 of HEALTH PHYSICS INSURANCE SEMINAR; [FEBRUARY 6-10, 1950]. Karl Z. Morgan. Mar. 12, 1951. 23p. (TID-388(paper 1))

A brief history of early experiences with x rays and radium and a list of early maximum permissible exposure values are followed by an extended discussion of modern health-physics problems, nomenclature in this field, and presently accepted permissible exposure levels of various radioisotopes. Duties of the health physicist are outlined, health-physics problems on off-AEC projects are discussed, and the relative safety of work on AEC projects is indicated. 8 figures.

4988
New York Operations Office
MAXIMUM PERMISSIBLE EXPOSURE OF PERSONNEL, paper 7 of HEALTH PHYSICS INSURANCE SEMINAR; [FEBRUARY 6-10, 1950]. Merril Eisenbud. Mar. 21, 1951. (TID-388(paper 7))

The following listing of maximum permissible exposures is included in a very brief discussion of human experience with radiation hazards.

External Radiation

Radiation	Permissible weekly dose: Roentgen	Rep	Rem
X or γ, whole body	0.30	0.30	0.30
Hands	1.5	1.5	1.5
β, whole body		0.5	0.5
Hands		1.5	1.5
Mixed β and γ		0.3	0.3
Mixed β-γ emitters	Internal Emitters		
Uranium	10^{-9} curie/m^3		
	50 μg/m^3		

4989
Brookhaven National Lab.
HEALTH PHYSICS INSTRUMENTS, paper 8 of HEALTH PHYSICS SEMINAR; [FEBRUARY 6-10, 1950]. J. B. H. Kuper. Mar. 12, 1951. 15p. (TID-388(paper 8))

Various types of personnel monitoring equipment and survey instruments in present use are illustrated. Simplified circuit diagrams are shown for Cutie Pie, Zeus, Zeuto, Beckman MX-2, and G-M counter instruments, and their operation and characteristics are described. Other types of instruments are mentioned briefly, and desirable developments in radiation instrumentation are suggested. 11 figures.

4990
New York Operations Office
MONITORING AND PROTECTION TECHNIQUES; I, paper 9 of HEALTH PHYSICS INSURANCE SEMINAR; [FEBRUARY 6-10, 1950]. Hanson Blatz. Mar. 12, 1951. 5p. (TID-388 (paper 9))

The procedures used in personnel monitoring by means of film badges, calibration of film badges, and evaluation of radiation received is discussed in a general manner.

4991
Brookhaven National Lab.
INSTRUMENT EVALUATION AND AIR SAMPLING, paper 10 of HEALTH PHYSICS INSURANCE SEMINAR;

[FEBRUARY 6–10, 1950]. David Balber. Mar. 12, 1951. 7p. (TID-388(paper 10))

The various types of establishments using radioisotopes or presenting radiation hazards from other sources are outlined, and selection of instruments appropriate to their requirements is discussed. A list of some companies producing monitoring equipment is given.

4992

Brookhaven National Lab.

MONITORING AND PROTECTION TECHNIQUES; II, paper 11 of HEALTH PHYSICS INSURANCE SEMINAR; [FEBRUARY 6–10, 1950]. F. P. Cowan. Mar. 12, 1951. 9p. (TID-388(paper 11))

The subject of shielding and time limitation of exposure to radiation is discussed in a general manner. In addition, a station used for area monitoring, and equipment for collecting dust from the air and for counting the β and γ activity present, are illustrated.

4993

New York Operations Office

SAFE PRACTICES IN HANDLING RADIOACTIVE MATERIALS, paper 12 of HEALTH PHYSICS INSURANCE SEMINAR; [FEBRUARY 6–10, 1950]. Hanson Blatz. Mar. 12, 1951. 6p. (TID-388(paper 12))

The objectives of health physics activities are listed, and numerous considerations involved in controlling radiation hazards, such as areas in the laboratory readily contaminated, personal factors in selecting personnel, special laboratory tools and equipment required, and problems of decontamination are discussed briefly.

4994

Isotopes Div., AEC

DECONTAMINATION AND DISPOSAL OF RADIOACTIVE WASTES, paper 14 of HEALTH PHYSICS INSURANCE SEMINAR; [FEBRUARY 6–10, 1950]. G. W. Morgan. Mar. 12, 1951. 17p. (TID-388(paper 14))

Methods of decontaminating structural materials, glassware, porcelain, metals, plastics, clothing, and hands and body are discussed. Interim recommended procedures for the disposal of I^{131}, P^{32}, and C^{14} are outlined, and the general methods of disposal of radioactive materials by dilution with water or air, concentration, storage, and burial on land or at sea are discussed. Tables list permanent and strip coatings and their manufacturers, permissible amounts and concentrations of radioisotopes, natural radioactivity of some United States water sources, and quantities in millicuries of radioisotopes shipped to various cities. 6 figures.

4995

Naval Radiological Defense Lab.

A QUANTITATIVE STUDY OF PERCUTANEOUS ABSORPTION; IV. ABSORPTION OF MINUTE QUANTITIES OF RADIOSTRONTIUM CHLORIDE THROUGH BURNED RAT SKIN. (Technical Objective AW-6). R. Kenneth Loeffler, John W. Herron, and V. Thomas. Apr. 2, 1951. 25p. (AD-308(B))

The effect of thermal burns on percutaneous absorption of radiostrontium chloride has been studied. Burns were given both before and after contamination of intact and abraded rat skin with radiostrontium chloride. Intact skin with moderately severe or severe burns showed a tendency toward less absorption than unburned skin. This effect was noted when thermal energy was applied during the period from 24 hr preceding application of strontium chloride to 5 min following this contamination. No decrease in absorption was found following suberythemal energy doses. Absorption through abraded skin varied when thermal energy was applied 1 min after contamination. Specifically, in the suberythemal and first-degree burn range, absorption tended to increase. In the second- and third-degree burn range, absorption decreased. A much greater concentration of absorbed strontium was found in tissues surrounding the contaminated, burned area than was found underneath contaminated skin that was normal or mechanically damaged. This was noted even at an energy dosage slightly below that causing visible skin change. (auth).

4996

Naval Radiological Defense Lab.

A QUANTITATIVE STUDY OF PERCUTANEOUS ABSORPTION; V. TREATMENT OF CONTAMINATED SKIN AND WOUNDS TO PREVENT ABSORPTION OF RADIOACTIVE SALTS. (Technical Objective AW-6). R. Kenneth Loeffler and John W. Herron. Apr. 2, 1951. 21p. (AD-309(B))

Experimental data from previous reports (AD-225(B), 254(B), 290(B), 308(B)) on bodily absorption of $Sr^{89}Cl_2$ and $Sr^{89}SO_4$ through intact, mechanically-damaged, and thermally-burned skin were used as a basis for the testing of several methods and agents for treating contaminated skin and wounds. Pretreatment of skin, care of rats, preparation of contaminating material, and general analytical procedures are explained. It was found that neither arterial nor venous tourniquets prevent absorption of radiostrontium chloride through either intact or abraded rat skin. However, a tourniquet exerting pressure greater than normal venous pressure will lessen absorption into the system. An arterial tourniquet will prevent absorption of material into the system. A variety of cleansing agents were tested alone and in combination. Some of them were tap water, tincture of green soap, Ivory soap, TiO_2 slurry, the disodium salt of ethylene diamine tetra-acetic acid (EDTA), and tannic acid. Tide alone and with Epinephrine gave the best results as decontaminants. Epinephrine effectively hinders absorption, especially from abraded skin, during the first hour after contamination. Included is a discussion of possible practical applications of results.

4997

RADIOACTIVE DUST SEPARATION EQUIPMENT—III. Allan L. Bralove. Nucleonics 8, No. 6, 15-23, 33(1951) June.

The feasibility of applying newly developed equipment to future installations is considered. Several projected applications employing some form of particle growth accompanied by liquid-collection techniques are discussed at length, and preliminary sketches of possible designs are presented. Included are the methods of steam injection, sudden cooling, adiabatic expansion, and sonic vibration. The author suggests a new technique whereby production of pseudo-Brownian motion by sonic vibration might be applied to a coarse filtering medium. In conclusion the three articles in this series are summarized and desirable channels for future investigations are listed.

RADIOGRAPHY

4998

AUTOGRADIOGRAMS OF IRREGULAR SURFACES. Louise H. Jodrey and Karl M. Wilbur. Proc. Soc. Exptl. Biol. Med. 77, 80-2(1951) May.

A method of making autoradiograms of mollusk shells and bone by applying sheets of emulsion removed from Eastman Industrial X-ray Film, Type A, is explained.

RADIOTHERAPY

4999

New York Univ. Hospital and New York Univ.

STUDIES OF THORIUM X APPLIED TO HUMAN SKIN; I. ROUTES AND DEGREE OF PENETRATION AND SITES OF DEPOSITION OF THORIUM X APPLIED IN SELECTED VEHICLES. Victor H. Witten, Milton S. Ross, Eleanor

Oshry, Arthur B. Hyman, and Vera Holmstrom. [nd] 22p. (AECU-1470)

A basic problem which has remained unsolved in using thorium X (Ra^{224}) for therapy in dermatological conditions is whether Th X is confined to the surface or penetrates the skin in any way. A report is presented of an investigation of the routes and degree of penetration and sites of deposition, using nine pieces of tissue from eight different patients. Properties of Th X, including decay schemes, are discussed. Th X (adsorbed on CaCl in alcoholic solution) was applied to a small (about 5 mm^2) area of skin, previously cleansed with alcohol and walled off with rubber on Duco cement. The amount applied varied from 0.001 to 0.015 cm^3 and the strength from 0.06 to 3.0 μc. The area was covered with collodion and allowed to dry. One to five days later the collodion was stripped off, and the treated area excised. Radioautograms prepared from frozen sections of the tissue show the isotope penetrates the epidermis and is distributed through the prickle cell and basal layers, flows down the hair follicle and penetrates the follicular wall, and passes down the sweat duct and into the sweat gland. Radioautograms showing the deposition of Th X in human skin are included.

5000

Ohio State Univ.

RADIOACTIVE COBALT AS AN ADJUNCT TO CANCER SURGERY. Arthur G. James, Roger D. Williams, and Joseph L. Morton. [nd] 14p. (AECU-1577)

Irradiation of inoperable malignant tumors by means of Co^{60} in flexible nylon applicators is especially valuable in sites inaccessible or near large vessels, bone, or areas previously irradiated to the limit of tolerance. Case histories are reported to illustrate the use of Co^{60} in the head and neck areas, abdomen, chest, and extremities. (See also NSA 2-1003 and 5-3848)

TOXICOLOGY STUDIES

5001

Radiation Lab., Univ. of Calif.

METABOLIC PROPERTIES OF VARIOUS MATERIALS, p.4-40 of MEDICAL AND HEALTH PHYSICS QUARTERLY REPORT; JANUARY, FEBRUARY, AND MARCH, 1951. J. G. Hamilton. May 8, 1951. Decl. Aug. 6, 1951. 31p. (AECD-3219(p.4-40))

Tracer studies indicate thyroid uptake of At^{211} by monkeys is greater by a factor of 10 than uptake established for rat thyroids. This indicates that further studies must be done on monkeys before tracer studies can be done on man. Results are given of histopathological studies of rats which received intravenous injections of At^{211} in amounts varying from 0.5 μc to 150 μc and were sacrificed 41 days later. At the 150 μc dose level changes in the lacrimal glands and spleen were noted. At 10-μc levels the first indication of possible damage to thyroid tissue was noted, with marked changes at the 150-μc level. Photographs of radioautograms of thyroid tissue from rats and monkeys are presented which indicate a correlation between the character of deposition of both radioiodine and radioastatine in the thyroid gland, radiation injury produced by astatine, and variability of accumulation of these two radioelements from one follicle to another. Results of tissue distribution studies are presented in table form for rats given varying doses and sacrificed at varying time intervals after having received intravenous doses of Ru^{97}, Mo^{99}, Pd^{103}, Rh^{105}, Tb^{160}, $Re^{183,184}$, $Ir^{190,192}$, and Pb^{203}. Ru^{97} was prepared by the reaction Mo (γ,xn), and Ru^{103} was prepared by the reaction Mo^{100}(γ,n). Carrier free $Rh^{101,102}$ was prepared by the reaction Ru(d,xn) Carrier free $Ir^{190,192}$ was prepared by the reaction Os(d,xn). A procedure was developed for the production of F^{18} by the reaction O^{16}(γ,pn) using liquid water as the target substance. Carrier free Pb^{203} was prepared by the (d,2n) reaction on Tl. A preliminary study was made of the radiation induced reduction of CO_2 in 1M $FeSO_4$.

5002

Cancer Research Inst., New England Deaconess Hospital, Boston

CYTOLOGIC CHANGES FOLLOWING INTRAVENOUS INJECTION OF THORIUM DIOXIDE. William R. Christensen and Sheldon C. Sommers. [nd] 7p. (AECU-1535)

In view of reports in the literature of the toxic and possible carcinogenic effects of thorium dioxide when used as a contrast medium for radiological diagnosis, an attempt was made to induce malignant changes in the reticulo-endothelial systems of four rats following intravenous injection of colloidal thorium dioxide (Thorotrast—20% thorium dioxide by weight). After 15 months no gross changes of reticulo-endothelial systems were observed by x-ray examination. Microscopic studies showed the livers of two rats to exhibit marked hyperplasia of reticulo-endothelial cells, and anaplastic variation in size, shape, and chromatin arrangement of the affected cells. No invasion was found, but the areas were considered of precancerous significance.

5003

Rochester Univ.

HEMIN AND GLOBIN SYNTHESIS IN BERYLLIUM-INDUCED ANEMIA STUDIES WITH ALPHA C^{14}-ACETATE. H. E. Stokinger, K. I. Altman, and K. Salomon. Jan. 19, 1951. 1p. (UR-151)

The report is reproduced here in its entirety.

Previous findings in anemias resulting from acute starvation or exposure to x radiation have shown interference with hemoglobin synthesis. Since, in the aforementioned anemias, hemin synthesis was more markedly affected than globin synthesis, it was thought of interest to investigate other types of anemias in order to establish on a broader basis the causal relationship between anemia and biosynthetic activity. Another type of anemia investigated was that associated with acute, experimental beryllium poisoning. This anemia resembles a macrocytic type, is mild in degree, and is one of the most characteristic and consistent findings resulting from repeated, daily, 6-hr inhalation of beryllium dusts or mists. Three beryllium-exposed albino rabbits, which had a reduction of from 1 to 1.4×10^6 red cells/mm^3 and a mean corpuscular volume of from 86 to 100 μ^3, were injected with 25 μc alpha-C^{14}-acetate per kilogram body weight. Blood samples were withdrawn at suitable intervals thereafter and hemin (as protoporphyrindimethylester) and globin were isolated for C^{14} analysis. A comparison with three hematologically normal control rabbits revealed that the rate of hemin and globin synthesis is significantly slower in all three beryllium-exposed rabbits. The available data indicate that the rate of globin synthesis is more markedly affected than the rate of hemin synthesis.

5004

Atomic Energy Project, Univ. of Rochester

A PARTIAL BIBLIOGRAPHY ON URANIUM AND ITS COMPOUNDS WITH ESPECIAL REFERENCE TO PHARMACOLOGY AND TOXICOLOGY. Leo J. LaFrance. May 11, 1951. 32p. (UR-166)

This annotated bibliography contains 414 references to papers dealing with pharmacological, toxicological, and physiological effects of U and its compounds on animals. No references to the effects of U on plants are included.

5005

Atomic Energy Project, Univ. of Rochester

ACUTE TOXICITY OF INHALED BERYLLIUM; IV.

STUDIES OF BERYLLIUM FLUORIDE AT CONCENTRATIONS OF 10 AND 1 mg/m³. Robert H. Hall, L. T. Steadman, Catherine A. Stroud, James K. Scott, F. A. Smith, and Herbert E. Stokinger. July 17, 1951. 41p. (UR-177)

Pulmonary lesions have been produced in animals exposed daily to BeF_2 mist at concentrations of 10 and 1 mg/m³. These resemble closely the lung changes resulting from inhalation of $BeSO_4$. BeF_2 is acutely more toxic than $BeSO_4$. Exposure to 1 mg/m³ of BeF_2 (190μg of Be/m³) resulted in lung damage in cats, dogs, rabbits, and rats roughly comparable in extent and degree to that produced by 10 mg/m³ of $BeSO_4.6H_2O$ (420μg Be/m³). The most severe and extensive lesions occurred in the lungs of dogs, while the changes were minimal in rats and intermediate in cats and rabbits. Hematologic changes suggestive of the progressive development of macrocytic anemia occurred in dogs and rabbits during exposure to 1 mg of BeF_2/m³. The anemia was more severe than has been observed following inhalation of BeO dust or $BeSO_4$ mist. Be tended to accumulate in the lungs, pulmonary lymph nodes, liver, skeleton, and bone marrow of dogs. A considerably greater proportion of Be was distributed to the skeleton, liver, spleen, and kidneys of dogs following inhalation of BeF_2 than was found in studies of the insoluble BeO or the soluble and readily dissociated $BeSO_4$ mist. This difference might be due to transport of BeF_2 in the blood in the form of a soluble diffusible complex.

TRACER APPLICATIONS

5006

Oregon Univ. Medical School

METABOLISM OF CHOLESTEROL; I. INCORPORATION OF CHOLESTEROL C^{14} CARBON INTO FATTY ACIDS. John T. Van Bruggen, Tyra T. Hutchens, and Edward S. West. [nd] 13p. (AECU-1392)

The metabolic fate of cholesterol carbon was studied using C^{14}-labeled cholesterol. It appeared possible that acetate or a closely related two-carbon fragment might be a catabolic product of cholesterol metabolism, therefore tissue fatty acids synthesized from the products of labeled cholesterol metabolism might contain the label originally present in cholesterol. To check this possibility, C^{14}-labeled biosynthesized cholesterol in oil solution was fed to two young male rats by stomach tube in a series of doses, separation of liver, skin, carcass, brain, and gut into cholesterol and fatty-acid fractions indicated that all tissues studied contained C^{14}-labeled fatty acids. Labeled cholesterol also was present in all tissues studied. Appearance of the C^{14} of fed cholesterol in fatty acids suggests that cholesterol is, at least in part, degraded to a C_2 compound capable of being a precursor of fatty acids.

5007

Brookhaven National Lab.

THE PREPARATION OF RADIOACTIVE VITAMIN B_{12} BY DIRECT NEUTRON IRRADIATION. R. Christian Anderson and Yvette Delabarre. [nd] 3p. (AECU-1402)

The preparation of radioactive vitamin B_{12} by direct thermal-neutron irradiation is described. The cobalt atom in crystalline B_{12} was activated by the $Co^{59}(n,\gamma)Co^{60}$ reaction with the high Co^{60} retention and small over-all loss of biological activity. Purification of irradiated B_{12} yielded a fraction with ~80% of the original specific radioactivity and 100 ± 15% of the specific biological activity.

5008

Lankenau Hospital Research Inst. and Institute for Cancer Research, Philadelphia

STUDIES ON THE FATE OF ISOTOPICALLY LABELED METABOLITES IN THE OXIDATIVE METABOLISM OF TUMORS. Sidney Weinhouse. [nd] 26p. (AECU-1419)

High aerobic glycolysis is one of the few well-authenticated metabolic differences between normal and neoplastic cells. After reviewing available information on oxidation by various normal and neoplastic mouse and rat tissues of glucose, palmitate, lactic acid, and substrates of the citric acid cycle, including results of recent investigations, tabulated in this report, with C^{14}-labeled substrates, the author concludes that there is no qualitative or quantitative disturbance in the methods of carbohydrate or fatty acid metabolism in tumors, but that the rate of flow through the cellular cycle of carbohydrate carbon atoms is very rapid as compared to the action of oxidative and electron-transport enzymes. Lactic acid accumulation results from "backing up" of electrons and pyruvate, because neither the electron transport enzymes nor the enzymes for pyruvate oxidation can cope with the rapid formation of their substrates.

5009

Ames Lab.

THE METABOLISM OF SOY BEAN LEAVES; IV. ON THE TURNOVER OF CHLOROPHYLL. S. Aronoff and Leo P. Vernon. [nd] 16p. (AECU-1430)

Results of a study of the rate of turnover of chlorophyll due to the diurnal cycle of light and darkness, in which C^{14} was used as a tracer, are reported. Results indicate an undoubted minor variation in the chlorophyll content of leaves throughout a day; the metabolic turnover, however, is of a periodicity and magnitude more complex and profound than suggested by concentration differences. It appears that the chlorophyll molecule does not metabolize as a whole, but that parts of it turn over more rapidly than others.

5010

New York Univ.

INTERCELLULAR SODIUM AND POTASSIUM IN MAN. Norman Deane and Homer W. Smith. [nd] 12p. (AECU-1445)

Intracellular Na and K in man have been calculated from simultaneous studies of body-water distribution (total body water and extracellular fluid) and total-body electrolyte as measured by the isotope-dilution technique, using Na^{24} and K^{42} tracers. Intracellular K averaged 112 milliequiv/liter of intracellular water, 49 milliequiv/kg of cellular mass, and 87 milliequiv/kg of body solid. Intracellular Na averaged 37.0 milliequiv/liter of intracellular water, 17.6 milliequiv/kg of cellular mass and 35.7 milliequiv/kg of body solid. The average values for intracellular Na and K concentrations in man, as determined in this study, are in close agreement with comparable data obtained from studies in the dog and with estimates of intracellular electrolyte in man.

5011

Washington Univ., St. Louis, School of Medicine

ESTIMATION OF TOTAL-BODY SODIUM BY ISOTOPIC DILUTION; I. STUDIES ON YOUNG ADULTS. Gilbert B. Forbes and Anne Perley. [nd] 20p. (AECU-1448)

Measurements of total "exchangeable sodium" in 32 healthy young adults by the isotopic-dilution method (utilizing radiosodium^{24}) revealed an average value of 41.9 milliequiv and 39.5 milliequiv/kg of body weight for males and females, respectively, with a range of from 32 to 54 milliequiv/kg in males and from 36 to 42 milliequiv in females. An 18- to 24-hr equilibration period following Na^{24} administration was selected as optimum on the basis of the shape of the equilibration curve and tissue studies. Determination of Na specific activity in bone suggests that as much as 60% of the skeletal Na may be "fixed," that is, it does not exchange with Na^{24} during the equilibration period. The isotopic-dilution method measures that portion of the body Na most intimately

concerned with fluid balance. By indirect means, it was estimated that total exchangeable Na represents 82% of the actual amount of Na in the adult body.

5012

Presbyterian Hospital, Chicago

LIPID METABOLISM AND ATHERO SCLEROSIS. R. Gordon Gould. [nd] 46p. (AECU-1457)

Certain aspects of lipid metabolism bearing on atheromatosis, emphasizing recent studies on the origin of the plasma lipids, factors affecting endogenous lipid synthesis, relations between plasma and tissue lipids, and similar studies made using C^{14}, P^{32}, S^{35}, and other radioactive isotopes are reviewed. 87 references.

5013

Cancer Research Inst., New England Deaconess Hospital, Boston

A METHOD FOR DETERMINING THE BLOOD VOLUME OF THE RAT USING RADIOACTIVE PHOSPHORUS. Philip O'B. Montgomery. [nd] 9p. (AECU-1464)

A method for the determination of the blood volume of the rat by radioisotope dilution using P^{32} labeled red cells is described. In 34 normal adult white rats, the average blood volume was 6.3% of body weight, with a standard deviation of 0.7. In seven rats, the determination was repeated with a maximum error of ±1% body weight. These results are in agreement with those reported in the literature using different methods. (auth)

5014

Presbyterian Hospital, Chicago, and Illinois Univ.

STUDIES ON FACTORS CONTROLLING CHOLESTEROL SYNTHESIS IN THE BODY. R. Gordon Gould. [nd] 20p. (AECU-1468)

A review is presented of contributions to factual knowledge of lipid metabolism developed since 1946, using tracer techniques, with emphasis on cholesterol metabolism. Results of measurements of the relative rates of cholesterol turnover and of synthesis in intact animals using C^{14}-labeled acetate of high specific activity introduced intravenously are reported. From analysis of ten tissues from each of a series of rats killed 1, 4, and 24 hr after acetate injection, it was concluded that cholesterol synthesis takes place in all of the tissues analyzed. The origin of plasma cholesterol was investigated by measuring cholesterol synthesis in the hepatectomized dog. Results show that in the dog all endogenous plasma cholesterol is formed in the liver. Extrahepatic synthesis of cholesterol in many tissues in vivo was shown to be largely independent of plasma cholesterol turnover. Fatty-acid synthesis was also found to occur in almost all tissues in both normal and liverless animals, but was not detectable in the skin. Preliminary results of a study to determine whether cholesterol normally goes directly from liver into plasma or proceeds via bile and the intestinal tract and then reaches the blood by absorption, indicate that during a 4-hr period at least 10 times as much newly synthesized cholesterol went directly into plasma as was secreted in bile.

5015

Washington Univ., St. Louis. School of Medicine, St. Louis Children's Hospital, and St. Louis Maternity Hospital

DETERMINATION OF SODIUM 24 "SPACE" IN INFANTS, CHILDREN, AND ADULTS. Anne Perley, Gilbert B. Forbes, and Miriam M. Pennoyer. [nd] 13p. (AECU-1519)

The volume of fluid through which radioactive Na^{24} is rapidly distributed (sodium "space") has been measured in 37 infants and children and in 19 adult males. The period allowed for distribution of Na^{24} ranged from 1¾ to 4¼ hr. In 11 premature infants the sodium "space" averaged 43.5% of body weight and in 16 fullterm newborns 35.2%. In 7 children from 1 to 14 years of age, the values averaged 30.2%, and in 19 adult males 25.2%. Although the sodium "space" computed as per cent of body weight varied considerably in given weight ranges, the data indicate that the volume of fluid occupied by sodium in relation to body weight declines as growth proceeds. (auth)

5016

Washington Univ., St. Louis. School of Medicine and St. Louis Children's Hospital

ESTIMATION OF TOTAL BODY SODIUM BY ISOTOPIC DILUTION; II. STUDIES ON INFANTS AND CHILDREN; AN EXAMPLE OF A CONSTANT DIFFERENTIAL GROWTH RATIO. G. B. Forbes and Anne Perley. [nd] 21p. (AECU-1520)

Measurements of total exchangeable Na were made in a series of 21 infants and children by the isotopic dilution method, using Na^{24}. A comparison of the data for young infants with carcass analyses reported in the literature indicates that the two methods for determining total body Na give comparable results. Values for total exchangeable Na are highest in the young infant, averaging 70 milliequiv/kg in 3300-g newborn, and gradually decline in a curvilinear fashion with age until adult values are reached (approximately 42 milliequiv/kg). When all of the available data on total-body Na are brought together, a straight-line relationship results when Na content is plotted against body weight on a double logarithmic grid. Total-body Na thus conforms to the relative growth equation, $Na = bW^k$, throughout most of the growth period, from mid-fetal life to maturity. Regression equations have been calculated which allow mean values of total-body Na to be predicted for any given weight. Treatment of the data in this way suggests several tentative conclusions: total Na changes with body weight in a predictable systematic fashion, namely, as a fractional power of body weight, and behaves as a constant differential growth ratio. Predictions of the Na retention occurring as a result of normal growth can be made for any given weight. The intimate relation of the kidney to Na metabolism is further emphasized.

5017

Oregon Univ. Medical School

METABOLISM OF CHOLESTEROL; ABSORPTION, TISSUE DISTRIBUTION, AND FATTY ACID SYNTHESIS. J. T. Van Bruggen, T. T. Hutchens, and E. S. West. [nd] 2p. (AECU-1521)

This report is reproduced here in its entirety.

C^{14} labeled, biosynthesized cholesterol has been fed via stomach tube to two young male rats. One received 316 mg (57 cpm/mg), in 5 doses in oil. The other received 100 g (404 cpm/mg) in 4 doses in oil over 48 hr. Liver, skin, carcass, brain plus spinal cord, and gut and feces were separated into saponifiable and nonsaponifiable fractions. Radioassay of the cholesterol fractions indicated all tissues contained C^{14} sterols in the descending order of total activity: gut, carcass, liver, skin, and brain. Liver cholesterol had the highest specific activity (excluding gut cholesterol). Fatty acid fractions showed a C^{14} activity in the descending order for total activity: gut, skin, carcass, brain, and liver. Brain fatty acids showed specific activities exceeded only by gut fatty acid fractions. Liver glycogen of the second experiment had a specific activity of 0.07 counts/min/mg. All activities are reported as for $BaCO_3$ at infinite thickness. Total tissue C^{14} was 12% of the administered cholesterol activity. The activity of the fatty acids suggests that cholesterol is catabolized through a process that yields acetate fragments for fatty acid synthesis. At least 5% of the administered cholesterol activity was recovered in tissue fatty acids. The activity of the liver glycogen indicates that at least part of the molecule may enter carbohydrate synthesis cycles.

5018
Oregon Univ., Medical School
EFFECT OF FASTING UPON LIPOGENESIS IN THE INTACT ANIMAL. T. T. Hutchens, John T. Van Bruggen, C. K. Claycomb, W. J. Cathey, and E. S. West. [nd] 2p. (AECU-1522)

The report is reproduced here in its entirety.

A tracer amount of C^{14}, carboxyl labeled acetate was given to 200-g rats and CO_2 collected for 1 hr. The entire animal was then digested in alcoholic KOH and separated into saponifiable and nonsaponifiable fractions. Four animals were used after 1 hr of fasting, 4 at 24 hr, and then 2 each at 48, 72, 96, and 120 hr of fasting. One hour after the last meal (1 hr fast) the 200-g rats were able to incorporate 1.0% of the administered acetate C^{14} into total body cholesterol, 4.0% into body fatty acids, and put out 47% of the activity in CO_2. Evaluating the remainder of the data on the basis of 100% at 1 hr fast time, the degree of incorporation of acetate into cholesterol at 24, 48, 96, and 120 hr, amounted to 83, 60, 31, 34, and 41%, respectively. Fatty acids at these same intervals showed 53, 51, 39, 39, and 30% incorporation. The CO_2 collected, evaluated on the same basis, showed 115, 126, 65, 71, and 86%. Although the rats after the 120-hr fast had a weight loss up to 50% and a total fatty acid loss of 80%, fatty acids isolated had specific activities similar to those isolated from the 24-hr fasted animals. Total cholesterol did not change after 120 hr of fasting but cholestorol specific activities of 120-hr animals were lower than 24-hr animals. Dilution of labeled acetate by the excess breakdown of body lipid may account for some of the lowered total incorporation of acetate after prolonged fasting.

5019
Harvard Univ. Harvard Medical School and Peter Bent Brigham Hospital
SERUM ALBUMIN TURNOVER IN LAENNEC'S CIRRHOSIS AS MEASURED BY I^{131}-TAGGED ALBUMIN. Kenneth Sterling. [nd] 14p. (AECU-1523)

The serum albumin turnover rate in a group of 11 cases of Laennec's cirrhosis was studied by following the disappearance rate of intravenously administered I^{131}-tagged albumin. The cases of cirrhosis exhibited a longer half time and slower turnover rate than the normal controls. In cases with serum albumin of 2.5 g % or less the deviations from normal were more pronounced. The exchangeable albumin pool was not markedly below the normal, except in cases with pronounced hypoalbuminemia. Examples of other diseases with hypoalbuminemia were studied and the findings did not coincide with the picture observed in Laennec's cirrhosis. Possible implications of the albumin turnover data are discussed. (auth)

5020
Wisconsin Univ.
THE AMINO ACID COMPOSITION AND DISTRIBUTION OF N^{15} IN SOYBEAN ROOT NODULES SUPPLIED N^{15}-ENRICHED N_2. I. Zelitch, P. W. Wilson, and R. N. Burris. [nd] 15p. (AECU-1527)

The amino acid composition of soybean root nodules was determined by analysis of amino acid fractions separated by partition chromatography on starch columns. Arginine, ammonia, glutamic acid, lysine, and aspartic acid were the most abundant compounds. All of the common amino acids were present, and unidentified ninhydrin positive compounds constituted but a small percentage of the total nitrogen. The amino acids separated from the soluble portion of nodules from soybean plants supplied N^{15}-enriched N_2 for 6 hr were analyzed for N^{15}. The distribution of N^{15} was very similar to that observed in Azotobacter and Clostridium. The atom per cent N^{15} excess in glutamic acid was almost twice as high as that of any other amino acid and more than 3 times as high as that of aspartic acid. These observations furnish further evidence that ammonia is the key intermediate in symbiotic nitrogen fixation. (auth)

5021
Harvard Medical School, Peter Bent Brigham Hospital, Boston
THE TURNOVER RATE OF SERUM ALBUMIN IN MAN AS MEASURED BY I^{131}-TAGGED ALBUMIN. Kenneth Sterling. [nd] 34p. (AECU-1538)

Intravenous injection into normal men of a small amount of I^{131}-tagged albumin was followed by a relatively rapid initial fall in the radioactivity of the circulating plasma. After approximately 2 days the plasma radioactivity diminished more gradually. The rate of this gradual decline indicated the rate of replacement of tagged by untagged protein, or the turnover of serum albumin. The minute amount of albumin used could not have any significant effect on the serum-albumin level or on protein metabolism, thus permitting studies on the subject in a steady state. Mean values for weight of the exchangeable albumin pool and albumin turnover rate and half time are listed.

5022
Illinois Univ.
THE METABOLISM OF RADIOACTIVE VITAMIN B_{12}. Kendall B. W. Barbee and B. Connor Johnson. [nd] 8p. (AECU-1544)

Radioactive vitamin B_{12} has been given orally or subcutaneously to four adult white rats. The radioactivity (entirely B_{12}) was excreted primarily in the urine following injection, while the radioactivity (B_{12} + inorganic cobalt) was excreted primarily in the feces following oral administration. Distribution of the Co^{60}-labeled B_{12} in intestinal contents, blood, spleen, liver, and kidneys is tabulated.

5023
Presbyterian Hospital, Chicago
THE IN VITRO INTERCHANGE OF CHOLESTEROL BETWEEN PLASMA AND RED CELLS. JoAnne S. Hagerman and R. Gordon Gould. [nd] 12p. (AECU-1564)

Plasma and red cells containing C^{14}-labeled cholesterol were obtained from dogs fed with C^{14}-carboxyl-labeled acetate. These labeled blood components were separated and incubated for several hours with their unlabeled counterparts at 37°C with mild agitation under an atmosphere of 95% O_2–5% CO_2. The exchange of cholesterol between the two components was followed in each mixture by measuring the cholesterol specific activities at various time intervals during the incubation. It was observed that equipartition of red cell and plasma unesterified cholesterol was closely approached in 4 hr and 50% equilibration took place in 1 hr. Esterified cholesterol of plasma did not take part in the exchange phenomenon under these conditions. The possible significance of these results in relation to the nature of lipoproteins is discussed. (auth)

5024
Texas Agricultural Experiment Station
THE INTESTINAL ABSORPTION OF TRIGLYCERIDES. Raymond Reiser, Melvin J. Bryson, Mary Joyce Carr, and Kenneth A. Kuiken. [nd] 14p. (AECU-1585)

A study was made of the mechanism of fat absorption in the intestine by use of synthetic triglycerides in which the glycerol was labeled with C^{14} and the fatty acids with conjugated double bonds. A study of the resultant lymph lipids led to the following conclusions: (1) Approximately two-thirds of ingested triglycerides are not hydrolyzed during absorption. (2) The hydrolyzed fat is completely split, little or no mono-glycerides being formed. (3) Hydrolyzed glycerol is not utilized for resynthesis of lymph triglycerides but follows an independent metabolic pathway. (4) Half the lymph

phospholipid formed from ingested fat utilizes the hydrolyzed fatty acids only. The other half is synthesized from unhydrolyzed fat by the substitution of one fatty acid molecule by the phosphate group. (auth)

5025

Argonne National Lab.

ON THE DETERMINATION OF RETENTION BEHAVIOR AND EXPECTED TOTAL METABOLIC EXCRETION OF RADIOISOTOPES FROM DAILY EXCRETION DATA. Sylvanus A. Tyler and Joan Gurian. May 1951. 7p. (ANL-4661)

It has long been the practice to derive the retention function from excretion information and to estimate the total excretion by summing excretion values over a finite set of discrete collection times. Another way is described by which the time-course of excretion via urine and feces can be described by sums of exponential terms:

$$E(t) = \sum_{i=1}^{k} A_i e^{\alpha_i t}, \text{ where } k \leq n-1, \alpha_i < 0,$$

n is the total number of daily collections, and A_i and α_i are constants determined empirically. This description more nearly coincides with the generally accepted postulates concerning the phenomenon of metabolic exchange and permits a more exact determination of the expected total excreted material from the excretion components that can be measured over the time interval investigated. The cumulative excretion and retention functions are immediately obtained.

5026

Western Reserve Univ. School of Medicine

USE OF I^{131}-LABELED PROTEIN IN THE STUDY OF PROTEIN DIGESTION AND ABSORPTION. Paul S. Lavik and Robert W. Miller. Apr. 16, 1951. 14p. (NYO-1623)

A method is described by which the rate of protein digestion and absorption in the gastrointestinal tract can be readily estimated in vivo. It consists simply of measuring the uptake of radioactivity in the blood after feeding a test meal of protein that has been iodinated with I^{131}. The experiment consisted of establishing normal absorption curves for each dog before and after depancreatizing. The depancreatized dogs showed a decreased I^{131} uptake in the blood when fed a test meal of I^{131}-labeled protein. The maximum deviation from normal occurred 60 min after the protein meal was gavaged. The method may be of some value in the diagnosis and study of certain digestive disorders in the human; specifically, the method could be employed in estimating the relative activity of proteolytic enzymes in the gastrointestinal tract.

5027

Tennessee Univ.

QUARTERLY PROGRESS AND WORK ACCOMPLISHMENT REPORT FOR QUARTER ENDING MARCH 31, 1951. Mar. 31, 1951. 23p. (ORO-35)

Techniques for the preparation of radioautograms of large bones, using a band saw enclosed in a dry box for cutting, are given. In a study of bone deposition of Ca, P, and Sr in weanling pigs, radioautograms and tissue distribution studies from bones of animals sacrificed at periods varying from 2½ min to 60 days after injection show that all three elements are deposited very rapidly in bone. The portion of the element deposited in the epiphyseal region is removed relatively rapidly; however, that deposited in the shaft is removed very slowly, if at all. Absorption and distribution of Ca in both dam and fetus when Ca^{45} was administered orally to the dam were studied. Data indicate no effect of the period of gestation upon Ca metabolism in the dam; however, Ca uptake and turnover in fetal bones always exceeded that in the bones of the dam and there were definite age effects on uptake in fetal bones. A study of the effect of time after intravenous administration of Ca^{45} on the uptake of Ca in dam and fetus showed the fetus bones show greater turnover than those of the dam, the epiphyseal region and the rib shows greater uptake than the metatarsus. Tissue distribution data are presented on a study of effects of current dietary Ca intake and past diet on the utilization of a single oral dose of Ca^{45} by rats. A preliminary study of the effects of irradiation upon the oxygen consumption of spermatozoa showed a lowering of oxygen consumption following the addition of P^{32} to semen. Progress is reported on numerous other projects.

5028

Southern Research Inst.

BODY RETENTION OF CARBON 14. (Status Report No. 9) Jan. 12, 1951. 18p. (ORO-41)

Preliminary results are reported on a new experiment having to do with long-term retention of C^{14} in bone and bone fractions. After a period of 4 months, the greatest part of the injected C^{14} can be found in the bone. The "active" volume of the bone shaft was receiving approximately 0.16 rep/day from 1 to 2 weeks after injection of 18μc of $NaHC^{14}O_3$ and about 0.04 rep/day at from 5 to 6 months. In studies of the effect of C^{14}-formate on the pattern of deaths from spontaneous leukemia in Akm mice which have been under way about 4½ months, experimental animals have now received a total of 200 μc each. None of the mice in either the experimental or control groups has developed leukemia to date. Rather extensive studies have now been completed on the incorporation and turnover of C^{14} from sodium formate in normal and neoplastic mice. In mice with lymphoid Ak 4 leukemia, the thymus, spleen, and lymph nodes have been observed to incorporate C^{14} from formate much more rapidly than was the case in normal mice. Sarcoma 180 tissue picks up C^{14} rapidly when compared to most other tissues. Blood-smear autoradiograms have shown that C^{14} from formate is present in leukemic cells in relatively high levels at 1 hr after injection while normal lymphocytes, myelocytes, or erythrocytes are almost entirely inactive at this time.

5029

Isotope Div., AEC

PRESENT AND FUTURE USE OF RADIOACTIVE ISOTOPES, paper 2 of HEALTH PHYSICS INSURANCE SEMINAR; [FEBRUARY 6–10, 1950]. Paul C. Aebersold. Mar. 12, 1951. 26p. (TID-388(paper 2))

A brief, popular account of the nature of radioactive and stable isotopes is followed by a graphic presentation of the use of radioisotopes in medical research and diagnosis, agriculture, and industry. 29 figures.

5030

Radiation Lab., Univ. of Calif.

THE PATH OF CARBON IN PHOTOSYNTHESIS; THE CARBOXYLIC ACIDS. J. A. Bassham. June 1949. 75p. (UCRL-735)

Methods have been developed for the separation, isolation, identification, and degradation of the carboxylic acids formed in the reduction of CO_2 during photosynthesis. These methods have been applied, and the results indicate that the primary reduction of CO_2 during photosynthesis takes place via two carboxylations of a two-carbon acceptor followed by splitting and reduction of the resulting four-carbon acid to two new molecules of acceptor. One molecule of acceptor is then used to continue the reductive cycle and the other is used in photosynthesis. The participation of 2-phosphoglyceric acid, phosphoenolpyruvate, phosphoenoloxalacetate, and glycollate in the cycle are discussed, and a tentative cycle is proposed. 12 figures. (auth)

5031
Radiation Lab., Univ. of Calif.
STUDIES IN GLYCINE-2-C^{14} METABOLISM IN MAN; I. THE PULMONARY EXCRETION OF $C^{14}O_2$. N. I. Berlin, B. M. Tolbert, and J. H. Lawrence. Sept. 1, 1950. 13p. (UCRL-892)

The rate of excretion by man of C^{14} via the lungs when administered as glycine-2-C^{14} in 3 patients has been determined. This pulmonary excretion has been described in terms of three rate processes, the slowest of which has a half time of 7 to 14 days. In 55 days approximately 83 to 92% of the C^{14} is excreted via the lungs, 5% via the urine, and 2% is retained in the red blood cells during their life span. The lack of hazard involved in the use of C^{14} in the manner described is discussed from the standpoints of excretion and possible retention in chemical compounds having a long turnover time. (auth)

5032
Radiation Lab., Univ. of Calif.
IDENTIFICATION OF RIBULOSE PHOSPHATES IN $C^{14}O_2$ PHOTOSYNTHESIS PRODUCTS. A. A. Benson. May 15, 1951. 3p. (UCRL-1281)

The intermediates involved in CO_2 fixation by plants are largely phosphorylated hydroxy acids and sugars. A compound observed during the first few seconds of $C^{14}O_2$ photosynthesis in all the plants investigated in this laboratory has now been identified by chromatographic analysis and chemical tests as ribulose (adenose) diphosphate.

5033
Virus Lab. and Radiation Lab., Univ. of Calif.
THE UTILIZATION OF THE THREE SINGLY-C^{14}-MARKED LACTIC ACIDS BY ESCHERICHIA COLI. Dean Fraser and Bert Tolbert. July 1951. 7p. (UCRL-1361)

Study of the utilization of the three C^{14}-singly-labeled lactic acids by Escherichia coli has shown that carboxyl C is largely, but not exclusively, converted to CO_2. The α and β carbons are mostly utilized in synthetic reactions but some is converted to CO_2 and an appreciable amount of the C_2 fragment left from decarboxylation of the lactate is excreted into the medium. Casein hydrolysate is apparently used synthetically and used as an energy source in preference to the C_2 fragment. (auth)

5034
Radiation Lab., Univ. of Calif.
THE PATH OF CARBON IN PHOTOSYNTHESIS XII: SOME TEMPERATURE EFFECTS. C. Ouellet. June 25, 1951. 12p. (UCRL-1366)

The photosynthetic assimilation of $C^{14}O_2$ for 2-min periods by Scenedesmus has been studied at temperatures ranging from 25 to 44°C. All labeled intermediates cease to be formed at about 45°C. With rising temperature, the radioactivity reaching the sugar phosphate reservoirs decreases regularly while there is a sharp maximum in sucrose at 37°C and a less pronounced one in malic and aspartic acids above 40°C. A tentative interpretation of these effects is offered. (auth)

5035
Radiation Lab., Univ. of Calif.
RADIOCALCIUM TURNOVER AND EXCRETION IN ADULT, YOUNG, AND RACHITIC RATS. (abstract) D. H. Copp and D. M. Thomson. July 1951. 1p. (UCRL-1401)

The report is reproduced here in its entirety.

The bone turnover and urinary excretion of radiocalcium (Ca^{45}) was studied in mature female rats, in normal young animals 2 months old, and in rats of the same age made rachitic by restricting them to a synthetic low-phosphorus diet from weaning. They were sacrificed at intervals up to 16 days following IV injection of Ca^{45}.

Initial bone uptake of Ca^{45} was rapid in both groups of young animals. In the normals, it remained fixed in the skeleton; in the rachitic rats it appeared "labile," and was rapidly removed. Uptake in adult bone was slower. Urinary excretion of radiocalcium was very high in the rachitic group, and the renal clearance of Ca^{45} was 10 to 15 times as great as in young or adult normal animals. This suggests a direct effect of low-phosphorus rickets on calcium excretion by the kidney.

5036
Radiation Lab., Univ. of Calif.
CARBON DIOXIDE FIXATION BY MICROORGANISMS. Victoria H. Lynch and Melvin Calvin. July 24, 1951. 15p. (UCRL-1411)

The stream of biochemical evolution may be divided into two stages, the earlier involving increasing biosynthetic ability, leading eventually to completely autotrophic organisms, the other involving the subsequent progressive loss of biosynthetic ability. Since it is conceivable that some heterotrophic organisms alive today might belong to the earlier stage, the problem of finding criteria between such precursors to an autotroph and products of loss of synthetic ability is of interest. Representative organisms, namely, an oxidative yeast, Hansenula anomala; a protozoon, Tetrahymena geleii; two water molds, Allomyces arbuscula and Blastocladia pringsheimii; three photosynthetic algae, Scenedesmus D_2, Chlorella pyrenoidosa, and Synechococcus cedorum; a slime mold, Physarum polycephalum; and three bacteria, Azotobacter agilis, Butyribacterium rettgeri, and Clostridium kluyveri, were investigated by dark exposure to $C^{14}O_2$ for 40 min followed by chromatographic separation of labeled amino acids, polysaccharides, and intermediates. No criterion was found, since the pattern of dark CO_2 fixation seems to be very much the same in all the organisms, with the possible exception of the bacteria, leading to the conclusion of a single origin of all these systems. The pattern of CO_2-fixed compounds is most readily and simply accounted for by the universal existence of a single, well-established reversible carboxylation reaction of pyruvic acid leading to oxaloacetic acid and malic acid.

CHEMISTRY

5037
Argonne National Lab.
PROTACTINIUM CHEMISTRY II. (abstract) R. Elson, S. Fried, P. Sellers, and W. Zachariasen. Feb. 7, 1951. Decl. May 24, 1951. 1p. (AECD-3168; ANL-WMM-784)

The report is reproduced here in its entirety.

Further work on protactinium compounds has resulted in the preparation of the metal, hydride, tetrafluoride, monoxide, dioxide, oxysulfide, nitride, iodide, and bromide. Up to 150 μ of protactinium were used in these preparations. Dr. W. H. Zachariasen was able to obtain and interpret the X-ray-diffraction patterns for most of the above compounds. He found the crystal structure of the metal to be tetragonal and calculated its density to be 15.7. The PaO, PaO_2, PaH_3, PaF_4, PaOS, and PaN were found to be isostructural with the respective uranium compounds. Descriptions and some prop-

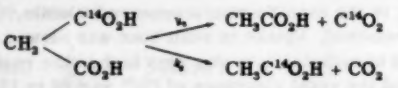
erties of the compounds are given. A preliminary study of the oxide system indicates the existence of several phases; the compositions range from PaO_2 to $PaO_{2.5}$.

5038

Radioisotope Lab. and Venable Chemical Lab., Univ. of North Carolina

DETERMINATION OF AN ISOTOPE EFFECT IN THE DECARBOXYLATION OF MALONIC ACID-1-C^{14}. Arthur Roe and Max Hellmann. [nd] 4p. (AECU-1372)

Experiments have been conducted to evaluate the isotope effect (the ratio of frequency of rupture of a C^{12}-C^{12} bond to that of a C^{12}-C^{14} bond) in the decarboxylation of malonic acid. The preparation of the malonic acid and procedure used in separating and measuring components is outlined. From 10 determinations, the isotope effect, k_3/k_4, for the reaction



was found to be 1.06 ± 0.02, which approaches the theoretical value of 1.04 calculated by Bigeleisen (J. Chem. Phys. 17, 425(1949)).

5039

Argonne National Lab.

ION EXCHANGE STUDIES OF SOME COMPLEX IONS. Jack Schubert. May 1951. 22p. (AECU-1395; UAC-389)

After a brief review of the literature on the use of ion exchange substances for the investigation of the association of complex ions, the author presents the results of studies on Dowex 50 of the interaction of Ca^{++} and Sr^{++} with aspartic, succinic, malic, citric, and tartaric acids, butylamine, and ethanolamine, in the presence and absence of formaldehyde. In most instances, the solutions were kept at a pH 7.2 to 7.3 and an ionic strength of 0.16 in order to approximate physiological conditions. Some preliminary results also are given of the effect of temperature and ionic strength on the stability of alkaline earth–organic acid complex ions. Tracer Ca^{45} and $Sr^{89,90}$ were used in this investigation.

5040

[Northwestern Univ.]

MECHANISM OF SUBSTITUTION REACTIONS IN COMPLEX IONS; II. STEREOCHEMICAL CHANGES ACCOMPANYING SOME REACTIONS OF COBALT (III) COMPLEXES. Fred Basolo, Bob D. Stone, and Ralph G. Pearson. [nd] 10p. (AECU-1421)

The absorption spectra technique has been used for the determination of stereoisomers occurring from reactions of Co(III) complexes. The data collected by this technique allow a semiquantitative determination of the amounts of cis and trans isomers obtained as products of the reaction without isolating them from the reaction mixture.

5041

Northwestern Univ.

MECHANISM OF SUBSTITUTION REACTIONS IN COMPLEX IONS; I. KINETICS OF THE AQUATION AND HYDROLYSIS OF SOME C-SUBSTITUTED ACETATOPENTAAMMINECOBALT(III) IONS. Fred Basolo, John G. Bergmann, and Ralph G. Pearson. [nd] 10p. (AECU-1422)

The rates of aquation and hydrolysis of several C-substituted acetatopentaamminecobalt(III) complex ions have been measured. These have been found to be dependent upon the base strength of the coordinated ligand but independent of its size. This has been interpreted to mean that the incoming group approaches the complex from a position opposite to that of the group being displaced. (auth)

5042

Wisconsin Univ.

REACTIONS OF IONS IN AQUEOUS SOLUTION WITH GLASS SURFACES. Arthur O. Long and John E. Willard. [nd] 18p. (AECU-1433)

Experiments designed to give further information on the mechanism of interaction of aqueous solutions with glass surfaces, with particular emphasis on the question of whether the sorption of ions is a simple base-exchange process are reported. It is indicated that the temperature coefficient of the sorption of Na ions from aqueous solution by soft glass is independent of the pH of the solution over the range 3 to 11 and independent of pretreatment of the glass by prolonged soaking in acid. Water and 0.1N HNO_3 are about equally effective in leaching Na^{24} activity from glass which has been bombarded with neutrons. Glass which has been subjected to 330 hr of soaking in acid, water, or salt solutions prior to bombardment releases less, but still significant amounts, of Na^{24} activity to the leaching solution. Soaked glass also sorbs less Na ion from aqueous solution than nonsoaked glass. Simultaneous sorption and desorption of Na ions by glass has been observed with the aid of Na^{24} and Na^{22}. Sorption of Cs^{134} ions by glass flamed to the softening point is much less than by glass moderately flamed. Sorbed Cs activity is desorbed by water rinses more rapidly than Na activity, but the rate can be reduced by substituting acetone rinses. Slight but rapid sorption on glass of Fe^{59}(III) in 0.1N HCl has been observed. (auth)

5043

Sloan-Kettering Inst. for Cancer Research

STUDIES ON THE STRUCTURE OF NUCLEIC ACIDS IV; INVESTIGATION OF DYE INTERACTIONS BY PARTITION ANALYSIS. Liebe F. Cavalieri, Alice Angelos, and M. Earl Balis. [nd] 22p. (AECU-1455)

A study was made, by the method of partition analysis, of the interaction of both desoxypentose and pentose nucleic acids with rosaniline and trimethyl-(p-(p-hydroxybenzeneazo)-phenyl)-ammonium chloride. The total number of available sites differs for the two dyes. This effect is interpretated in terms of heterogeneity among the sites. Competitive effects of Mg ions have been investigated both by the method of equilibrium dialysis and partition analysis. Approximate binding constants for the Mg ion are tabulated. The competitive interaction of bovine serum albumin with desoxypentose and pentose nucleic acids has been examined in the presence of the above-mentioned dyes. There is no evidence of combination between albumin and either nucleic acid. (auth)

5044

Sloan-Kettering Inst. for Cancer Research

THE EFFECT OF THE CALCIUM HYDROXIDE-CALCIUM ALUMINATE ANTIBODY PURIFICATION PROCEDURE ON THE PHYSICAL PROPERTIES OF RABBIT GAMMA GLOBULIN. L. A. Sternberger and M. L. Petermann. [nd] 16p. (AECU-1458)

The calcium hydroxide–calcium aluminate treatment used for the purification of antiprotein antibody has been applied to rabbit gamma globulin, and its effect on molecular structure has been followed by electrophoretic sedimentation and viscosity measurements. No appreciable alteration occurred when the treatment was carried out at pH 11.4; at pH 12.6 some unfolding of the molecule occurred. (auth)

5045

Sloan-Kettering Inst. for Cancer Research

A PROPOSED REVISION OF THE STRUCTURAL FORMULAE OF VICINE AND DIVICINE. Aaron Bendich. [nd] 4p. (AECU-1459)

Vicine, a pyrimidine glucoside, is assigned the structure of a 5-O-D-glucoside of 2,4-diamino-5,6-dihydroxypyrimidine rather than a 3-N-glucoside of 2,5-diamino-4,6-dihydroxypyrimidine, as generally accepted. The aglycone, divicine, thus also is assigned a new formula. The reason

for differences in stability of vicine and divicine in aqueous solution and the synthesis of divicine are now being investigated.

5046

Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.

REPORT OF PROGRESS AND EXPENDITURES; JULY 1, 1950, TO JUNE 30, 1951. [nd] 65p. (AECU-1467)

This is an administrative report of activities of the Chemistry of the Fission Elements, Nuclear Chemistry (Organic), and Nuclear Chemistry (Inorganic) Groups and of budget considerations. No technical data are included.

5047

Oregon State Coll.

ISOTOPE EFFECT IN THE OXIDATION OF CARBOXYL-C^{14} ACETIC ACID. E. A. Evans and John L. Huston. [nd] 2p. (AECU-1528)

The report is reproduced here in its entirety.

Several recent studies of isotope fractionation effects occurring in the formation of acetic acid by decarboxylations of malonic acid have involved wet combustions of these two acids (Roe and Hellmann, J. Chem. Phys. 19, 660 (1951); Bigeleisen and Friedman, J. Chem. Phys. 17, 998 (1949); Lindsay, Bourns, and Thode, Can. J. Chem. 29, 192 (1951)).

In the course of work in this laboratory involving the study of anhydrous acetic acid as an ionizing solvent, it has been noted that the wet combustion procedure is, itself, subject to an isotope rate effect when applied to the rather difficultly oxidizable acetic acid. In other words, $CH_3C^{13}O_2H$ is oxidized more rapidly than $CH_3C^{14}O_2H$ and unless precautions are taken to insure complete combustion of a sample of acetic acid a low specific activity is found.

In studying this isotope effect, the CO_2 formed during a wet combustion of carboxyl-C^{14} acetic acid by the procedure of Van Slyke and Folch (J. Biol. Chem. 136, 509 (1940)) was collected as two consecutive fractions of roughly the same weight, absorbed in barium hydroxide solutions, and counted as barium carbonate on copper planchets. The acid was formed in situ by the addition of sodium acetate to the oxidation fluid. Approximately 50 mg of the salt were used in each run. Blanks due to atmospheric CO_2 or SO_2 from the oxidizing mixture were negligible.

A number of runs were made in investigating this effect, during the course of which several revisions were made in our experimental procedure. The isotope effect was consistently observed in all these runs. For six consecutive combustions which were made after the last revision an average value of 1.06, with an average experimental deviation of ±0.02, was obtained for the ratios of the specific activities of the second fractions to those of the first fractions. The nature of the combustion procedure and the lack of precision inherent in the counting technique are such that correlation of the size of the effect with the relative amounts of the two fractions was not considered feasible. It is interesting to note, however, that the value obtained is comparable in magnitude to other recently reported isotope rate effects, such as those for labeled malonic acid and the ones found in recent precise decarboxylation studies of mesitoic acid and trichloroacetate ions (Bothner-By and Bigeleisen, J. Chem. Phys. 19, 755 (1951); Bigeleisen and Allen, J. Chem. Phys. 19, 760 (1951).

5048

Louisville Univ.

EQUILIBRIA BETWEEN ALIPHATIC ACIDS AND A STRONG BASE ANION EXCHANGER. Sigfred Peterson and Robert W. Jeffers. [nd] 9p. (AECU-1541)

A study of the equilibria between aliphatic acids and the hydroxide of a strong-base-type resin Nalcite SAR is reported. The equilibrium measured is presumably ROH + HA = RA + H_2O where R represents 1 equivalent of resin cation. The anion of the acid neutralized replaces the hydroxide ion in the resin to maintain electrical neutrality of the phases. Equilibrium isotherms determined simultaneously at 30.3°C are shown for acetic, butyric, chloroacetic, formic, isobutyric, and propionic acids, with the acid neutralized per gram of resin plotted against the equilibrium concentration in the solution. A second series of measurements, divided between two temperatures, with seven acids including α- and β-chloropropionic, and crotonic, are plotted on another graph. That measurements at 18.0 and 30.3°C for any one acid fit the same curve within the reproducibility of the measurements shows a negligible temperature coefficient for the process. The lack of sensitivity of the method at low concentrations, the instability of the resin hydroxide as indicated by darkening on standing, and the true adsorption of acid by the resin prevent a correlation of the equilibria of formation of resin carboxylates with anion structure.

5049

Argonne National Lab.

THE MELTING CURVE OF He^3. B. M. Abraham, D. W. Osborne, and Bernard Weinstock. Aug. 1951. 8p. (AECU-1566)

Measurements of the melting pressure of He^3 have been made by the blocked capillary technique from 1.51 to 0.16°K. The data between 1.51 and 1.02°K were obtained by immersing the small tube which contained the He^3 directly in a bath of liquid He^4 boiling under reduced pressure. The data between 1.09 and 0.16°K were obtained by surrounding the cupro-Ni capillary with a paramagnetic salt (iron ammonium alum), which was cooled by adiabatic demagnetization. From 1.51 to 0.5°K the melting pressure follows the equation $P = 26.8 + 13.1\ T^2$ atm, but below 0.5°K the experimentally determined pressure rapidly approaches a constant value of 29.3 atm. It appears that the liquid is the stable condensed phase of He^3 at 0°K. (auth)

5050

Argonne National Lab.

LITERATURE SURVEY ON THE HALOGENATION OF POLAR ORGANIC COMPOUNDS. I. L. Faller. Apr. 1951. 21p. (ANL-4678)

Considerable interest in the halogenation of heavy metals in the presence of organic polar compounds has led to the present literature survey. Included in this survey are Grignard-type reactions and reactions involving metals (Al, Fe, Zn, Co, Ni, Sb, Mn, Sn, Zr, and Hf), halogens (not including F), and organic compounds. There are also sections on the halogenation of ketones, aldehydes, alcohols, ethers, acids, and acid anhydrides and a miscellaneous section on compounds that halogenate with extreme ease. Since the interest was centered primarily in learning which polar organic compounds do not halogenate easily, the survey is not complete insofar as the halogenation of all types of organic compounds is concerned. (auth)

5051

Brookhaven National Lab.

CHEMISTRY, p.62-78 of QUARTERLY PROGRESS REPORT; JANUARY 1–MARCH 31, 1951. A. A. Bothner-By, L. Friedman, R. Christian Anderson, A. Rahman, S. Freed, and K. M. Sancier. June 1951. 17p. (BNL-103(p.62-78))

Quinone-Hydroquinone Exchange Reactions. Quinhydrone complexes have been prepared from duroquinone and durohydroquinone, only one of which was labeled with C^{14}. Thermal decomposition in vacuum yielded the original compounds, no exchange of radioactive isotope having taken place after complex formation. The formulation of quinhydrones as symmetrical resonance hybrids is thus disproved.

N^{15} Tracer Study of Organic Azide Reactions. Nitric acid containing 31.4 at.% excess N^{15} was converted to KNO_2 which was used in the preparation of 3.5-dinitrobenzazide from 3.5-dinitrobenzhydrazide. Thermal decomposition of the azide gave N_2 containing all the excess heavy N isotope and dinitroaniline of normal isotopic composition. This confirms the currently accepted mechanism of the rupture of the α-β N-N bond followed by the elimination of a molecule of N_2.

The Light-metal Carbonyls. The study of the structure and uses in organic synthesis of the light-metal carbonyls has been extended. Yields of glycolic acid in excess of 80% can be obtained upon hydrolysis of Na or K carbonyl prepared in liquid ammonia. Application to isotopic syntheses and theoretical aspects of the reactions are discussed.

Absorption Spectra of Chlorophylls. The spectra of solutions of the chlorophylls a, b, and b′ have been measured from the temperature of liquid N_2 to room temperature. New features have appeared in the spectra which make it evident that each of the chlorophylls is an equilibrium mixture of two isomers. The temperature at which equal concentrations of the isomers coexist is about the same for chlorophyll a and chlorophyll b, but that for chlorophyll b′ is about 50° higher. It seems that another component, which has an absorption spectrum similar to chlorophyll b but which can be distinguished at low temperatures, is adsorbed with chlorophyll b on the chromatographic column.

5052

Hanford Works

ZIRCONIUM CHEMISTRY; THE NITRATE AND THENOYL TRIFLUORACETONE COMPLEXES AND THE HYDROLYTIC SPECIES. W. H. McVey. June 29, 1951. 22p. (HW-21487)

The effect on Zr distribution between aqueous and benzene phases of nitrate and thenoyl trifluoracetone (TTA or HK) complexing, hydrolysis, and polymerization was studied with 65-day Zr^{95} tracer. Only the first and second nitrate complexes, $ZrNO_3^{+3}$ and $Zr(NO_3)_2^{++}$ were found to be important in HNO_3 solutions up to 4.0M in concentration. At an ionic strength of 4.0, the equilibrium constants for the formation of these complexes were 0.586 and 0.090, respectively, these values being corrected for the presence of the aqueous TTA complex. The equilibrium constant for the formation of the first chelate, ZrK^{+3}, was 1084 at an ionic strength of 4.0. Only the first chelate was observed at TTA concentrations up to 10^{-4}M. Only two hydrolytic species of Zr, Zr^{+4} and $Zr(OH)_2^{++}$, were observed in dilute acid solution. The equilibrium constant for the formation of $Zr(OH)_2^{++}$ at ionic strength 4.0 increased from 0.40 to 0.65 as the Zr concentration was increased from 1.25×10^{-4}M to 2.50×10^{-4}M, indicating that polymerization accompanied hydrolysis. The amount of Zr monomer in a solution 0.0625M in Zr in 2M $HClO_4$ was found by optical density measurements to be 14.7%.

5053

Carbide and Carbon Chemicals Co., K-25

LOW TEMPERATURE THERMAL DATA ON BROMINE TRIFLUORIDE. George D. Oliver and J. W. Grisard. June 8, 1951. 12p. (K-765)

Molal heat capacity measurements were made on bromine trifluoride up to 320°K. The heat-of-fusion value at a triple point of 281.93 ± 0.05°K was 2874.7 ± 3.0 cal/mole. The entropies of the liquid and ideal gas at 298.16°K and 1 atm were 42.57 ± 0.10 and 71.57 cal/mole, respectively. (auth)

5054

Carbide and Carbon Chemicals Co., K-25

THE VAPOR PRESSURE AND HEAT OF VAPORIZATION OF BROMINE. J. W. Grissard and G. D. Oliver. June 8, 1951. 8p. (K-766)

The vapor pressure of BrF_3 has been measured over the range 39 to 155°C, and the following equation was derived by methods of least squares to represent the experimental data: $\log_{10} P_{mm} = 7.74853 - 1685.8/(t + 220.57)$. The heat of vaporization was estimated from the following equation, which is based upon the Clausius-Clapeyron relation:

$$\Delta H_{cal/mole} = 7714\,[(t + 273.16)/(t + 220.57)]^2.$$ (auth)

5055

Rensselaer Polytechnic Inst.

NATURE OF THE FERRIC CHLORIDE COMPLEX IN ISOPROPYL ETHER. L. G. Bassett, W. H. Bauer, H. M. Clark, S. E. Wiberley, J. Savolainen, A. Laurene, and D. Campbell. Feb. 1, 1951. 4p. (NYO-612)

Isopropyl ether extracts of aqueous HCl solutions containing $FeCl_3$ have a much higher electrical conductivity than extracts of HCl alone. An apparatus by which the effect of electrolysis on the two-phase system is being studied is sketched, and preliminary results indicating that the Fe complex migrates as a singly charged negative ion and that the protons are hydrated are summarized.

5056

Sintercast Corp. of America

PROGRESS REPORT FOR NOVEMBER 1, 1950, to JANUARY 31, 1951. C. G. Goetzel and R. B. Wagner. Feb. 1, 1951. 19p. (NYO-689)

The effects of Zr carbide particle size on microstructure and transverse rupture strength of cemented Zr carbide with 10% Ni binder are listed as well as milling effects on grain size, composition (contamination), density, and rupture strength. A series of tests was made on the stability of cemented Zr carbide bodies, containing various binders, at 1000°C in still air.

5057

Cornell Univ.

STRUCTURES OF FLUOROCARBONS, ELEMENTARY BORON, AND BORON COMPOUNDS [PROGRESS REPORT]. J. L. Hoard. July 1, 1951. 3p. (NYO-719)

No scientific data are available in this report, merely brief statements that certain papers on the structures of elementary boron and B-trichloroborazole have been submitted for publication and that the structures of C_6F_{12} and the dimethylamine-dichloroborine dimer are to be studied.

5058

Towne Scientific School, Univ. of Pennsylvania

THERMODYNAMIC STUDY OF IRON-OXYGEN-SULFUR SYSTEM. F. J. Dunkerley, J. L. Nichols, and V. V. Damiano. July 1, 1951. 15p. (NYO-733)

A résumé of the work performed during the first year of this contract is presented in this progress report. After discussing reasons for the unsuitability of the static system for the investigation of the Fe-O-S system, the authors describe an improved flow system utilizing a reaction chamber maintained at a constant elevated temperature and the experimental procedure used therewith. Data on runs made at 1600°C using a constant partial pressure of SO_2 (3.115×10^{-4} atm) are presented graphically. Experiments using H_2-reduction apparatus for determining O and S are reported, and methods for obtaining greater accuracy in O_2 analysis are discussed. Equilibria in the Fe-O-S system proposed by various authors are considered critically, and planned future work on the system is outlined.

5059

Sterling Chemistry Lab., Yale Univ.

MILLICOULOMETRY; III. THE POLAROGRAPHIC REDUC-

TION OF COPPER(II) FROM THIOCYANATE SOLUTIONS. Louis Meites. [nd] 6p. (NYO-806)

Polarograms of Cu(II) in thiocyanate solutions of various concentrations are described, and data from a millicoulometric electrolysis of Cu(II) in 1 F thiocyanate are tabulated. From these observations, it is concluded that the reduction corresponding to the first wave in 1 F thiocyanate proceeds directly to Cu amalgam and not to a Cu(I) complex, and that the second wave in concentrated thiocyanate solutions is actually catalytic in nature and cannot be interpreted as being due to the reduction of Cu(I). Results of other investigators are discussed.

5060

Tennessee Univ.

EFFECT OF WETTING ON HEAT TRANSFER CHARACTERISTICS OF LIQUID METALS. (First Quarterly Report). W. K. Stromquist. July 31, 1951. 7p. (ORO-39)

Brief note is made of preparations for this study. No technical data are given.

5061

Oak Ridge National Lab., Y-12 Area

MISCIBILITY OF ORGANIC SOLVENT PAIRS. J. S. Drury. May 31, 1951. 8p. (Y-773)

More than 700 pairs of selected organic solvents have been qualitatively examined for immiscibility. Results are tabulated in two tables. (auth)

5062

Naval Radiological Defense Lab.

THE CHEMICAL SPECIES OF THE ELEMENTS RESULTING FROM AN ATOMIC BOMB DETONATION IN AIR. (Final Report) L. R. Bunney and N. E. Ballou. May 25, 1951. 32p. (AD-325(C)

Estimates are made of the chemical nature of the products of an atomic bomb detonation occurring in air. The elements under consideration are the bomb materials: Fe (since the composition of the steel was not accurately known, such things as small percentages of Ni, Mn, etc., were estimated from the composition of armor plate); U or Pu; conventional explosives products; C, N_2, H_2 and O_2; and the fission products from Zn to Gd. The report comprises a discussion of the assumptions involved; a table listing the elements and their estimated predominant chemical species; a section devoted to brief outlines showing how the data listed in the table were arrived at, with reference notes; a short conclusion, in which the possible chemical effects of nuclear reactions are pointed out; and a bibliography.

5063

Royal Aircraft Establishment, Farnborough, Hants. (England)

THE BEND STRENGTH OF SINTERED ZIRCONIUM CARBIDE. A. R. Hall and W. Watt. Dec. 1950. 19p. (RAE-TN-MET-137)

A resistance-heated hot press for sintering carbides under pressure in graphite dies is described. Results of bend strength determinations at room temperature, 1050 and 1600°C for sintered compacts of Zr carbide are given, also electrical resistivity values at room temperature. The bend strength determinations show a considerable scatter, the majority falling in the range 11 to 15 Tsi. The maximum strength is reached before complete sintering occurs if the degree of sintering is judged by the electrical resistivity of the specimens. There is no drop in the bend strength of sintered Zr carbide at 1050 and 1600°C nor evidence of plastic flow under stresses of short duration at these temperatures. (auth)

5064

INTRAMOLECULAR ISOTOPIC FRACTIONATION—THE EXAMPLE OF NITROUS OXIDE. J. M. McCrea. J. Chem. Phys. 19, 48-9(1951) Jan.

The spectroscopic results of Richardson and Wilson (J. Chem. Phys. 18, 694(1950)) are used to calculate the partition function ratios for the isotopic species of nitrous oxide. A number of approximate calculations of types often necessary in other cases owing to limited data are given to show the errors introduced by these approximations. (auth)

ANALYTICAL PROCEDURES

5065

Mineral Engineering Lab., Mass. Inst. of Tech.

THE USE OF THE PAPER COLUMN SEPARATION IN THE ESTIMATION OF MICROGRAM QUANTITIES OF URANIUM. Richard H. Kennedy. June 7, 1950. Decl. June 26, 1951. 21p. (AECD-3187; MITG-A84)

By combining the paper-column separation with a microvolumetric, colorimetric, or fluorimetric method for determining U, the quantitative estimation of small concentrations of U in the presence of large concentrations of other elements has been simplified. In the paper-chromatographic method, the U in aqueous solution containing free HNO_3 is adsorbed on partially nitrated cellulose packed in a glass column. The adsorbed U is then selectively extracted from the column with diethyl ether containing HNO_3. The U in the solvent is then determined. The test work that was done to establish the quantitative separation of small amounts of U from elements that interfere with the fluorimetric method is presented. Several modifications of apparatus and procedure have been made which considerably increase the speed of the paper-column method. As little as 5.3×10^{-7} g of U as U_3O_8 has been separated quantitatively on the column prior to fluorimetric determination.

5066

Argonne National Lab.

A METHOD FOR SIMULTANEOUS ANALYSIS OF CARBON 14 AND TOTAL CARBON. Donald L. Buchanan and Akira Nakao. Apr. 1951. 31p. (AECU-1385; UAC-387)

An analytical method is described whereby a single sample of either organic or inorganic carbon-containing material may be assayed for total C content as well as C^{14} content. The C analysis is carried out by wet oxidation with subsequent purification of CO_2 in a vacuum system. CO_2 is measured manometrically and then transferred to a proportional gas counter for C^{14} determination. Reasonably accurate counts may be obtained with material having a specific activity of only 1 disintegration/min/millimole of C. The versatility of the method with respect to size of samples, chemical nature of samples, and amount of radioactivity present makes it particularly suitable for biological investigation. (auth)

5067

Ames Lab.

SPECTROPHOTOMETRIC DETERMINATION OF ALUMINUM AND IRON IN CALCIUM. Wilbur Sprain and Charles V. Banks. [nd] 8p. (AECU-1558)

A simple, rapid, and accurate method is described whereby micro amounts of Al and Fe can be determined in Ca metal. The Fe is determined spectrophotometrically by measuring the absorbency of the reddish-orange color of the tris(1,10-phenanthroline)iron(II) ion. This complex effectively removes the Fe interference, and the Al is determined spectrophotometrically in the solution remaining from the Fe determination by extracting it with a chloroform solution of 8-quinolinol and measuring the absorbency of the yellow color of the tris(8-quinolinolo)Al(III) in the chloroform solution. (auth)

5068

Argonne National Lab.

APPARATUS FOR CONTINUOUS ELECTROCHROMATOG-

RAPHY. Takuya R. Sato, William P. Norris, and Harold H. Strain. July 1951. 13p. (AECU-1575; UAC-428)

Apparatus similar to, but larger than, that of Strain and Sullivan (Anal. Chem. 23, 816(1951)) for the continuous separation of ionized solutes by simultaneous paper chromatography and differential electrical migration has been constructed. Maintenance of uniform flow of solvent in the cells has required the construction of special equipment for their support. Improvements have also been made in the addition of the electrolyte and of the mixture to the cells. Radioautographs of separations of Ca ion from phosphate and Ag ion from chromate achieved by these cells are shown.

5069

Columbia Univ.

CHEMICAL ANALYSIS BY RESONANCE ABSORPTION OF NEUTRONS. R. H. Anderson, T. I. Taylor, and W. W. Havens. Mar. 27, 1951. 16p. (CUD-91; DR-1629)

The one-level Breit-Wigner equation for the resonance absorption of neutrons may be used, provided the parameters for the particular element are known, to determine the quantity of the element in an unknown sample. Theoretical transmittance curves for In have been calculated from this equation and from data given by Havens et al. (Phys. Rev. 71, 165-73(1947)), and working curves have been determined for In in synthetic Sn samples. Experimental results on In in Sn, as determined by a time-of-flight method on neutrons from a pulsed cyclotron beam, are presented and discussed.

5070

Department of Mines and Resources, Mines Branch, Ottawa (Canada).

THE DETERMINATION OF Na_2CO_3 AND $NaHCO_3$ IN THE PRESENCE OF Na_3PO_4 AND Na_3AsO_4, USING A BECKMAN ELECTROTITRIMETER (Topical Report No. TR-84/51). H. J. Herbst. [nd] 6p. (NP-3127)

Na_2CO_3 and $NaHCO_3$ may be titrated with HCl using phenolphthalein and methyl orange as indicators. If either Na_3PO_4 or Na_3AsO_4 is present, the amount of phosphate or arsenate must be determined separately, and the calculated amount of acid required for these salts must be subtracted from the total amount used to titrate the sample. The method of calculation is illustrated.

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

5071

Knolls Atomic Power Lab.

GROWTH AND CRYSTALLOGRAPHY OF DEFORMATION OF BETA PHASE URANIUM SINGLE CRYSTALS. A. N. Holden. May 18, 1951. Decl. Aug. 6, 1951. 17p. (AECD-3220; Memo-ANH-1)

A vertical tube furnace in which it has been possible to grow large β-phase U crystals is illustrated, and the physical properties and crystallography of deformation of the β phase are discussed in detail. A model of the β structure, standard projection on the 001 plane, and atom positions on slip planes are illustrated. A long-standing conclusion that the β phase was completely brittle has been negated. The single crystals of β phase are usually ductile and they deform by slip. The slip plane has been identified as the {110}type plane in the β crystal and the direction of slip as the $\langle 001 \rangle$ direction. Only when they are unfavorably oriented, do β crystals behave in a brittle fashion.

5072

Los Alamos Scientific Lab.

DISSOCIATION ENERGIES OF Cd^{++}-VACANCY COMPLEX AND DOUBLE-VACANCY IN SODIUM CHLORIDE. John R. Reitz and J. L. Gammel. [nd] 21p. (AECU-1349; LADC-902)

Dissociation energies for two types of lattice imperfection (namely, the impurity-ion vacancy complex and the double-vacancy) have been determined theoretically for NaCl, using the semiclassical model of ionic crystals developed by Born and Mayer. The procedure followed in calculating these energies was based on the method developed by Mott and Littleton (Trans. Faraday Soc. 34, 485(1938)) for computing the formation energies of single vacancies. The numerical results which were obtained are 0.44 and 0.89 ev for the dissociation energies of the complex and double-vacancy respectively. (auth)

5073

Iowa State Coll.

POSSIBLE EXISTENCE OF A SYMMETRICAL O···H···O HYDROGEN BOND IN NICKEL DIMETHYLGLYOXIME. L. Edward Godycki, R. E. Rundle, Roger C. Voter, and Charles V. Banks. June 30, 1951. 3p. (AECU-1478)

X-ray-diffraction studies indicate that nickel dimethylglyoxime is orthorhombic, space group Ibam, a_0 = 16.6, b_0 = 10.4, c_0 = 6.49 A, Z = 4. The x-ray study has proceeded through one steepest descent refinement and two three-dimensional Fourier sections, $\rho(xy0)$. The O···H···O distance, 2.42 A, is significantly lower than any heretofore reported. No infrared-absorption maxima in the range 2.7 to 4.0 μ which are characteristic of either "free" or normally hydrogen-bonded O−H were observed. These studies suggest that the O···H···O bond is unusually strong, and may indicate a symmetrical bond (hydrogen in center). The predicted distance for the symmetrical O···H···O bond is 2.32.

5074

Columbia Univ.

FREE ENERGY CHANGES IN THE β_1-β' TRANSFORMATION IN THE ALLOY AU Cd. (abstract) D. S. Lieberman, T. A. Read, and L. C. Chang. [nd] 1p. (AECU-1550)

The report is reproduced here in its entirety.

Single crystals of AuCd undergo a diffusionless phase transformation from an ordered body-centered cubic structure above the transition temperature to an orthorhombic structure below it. The low-temperature orthorhombic phase consists of an aggregate of domains or a single domain depending on the annealing procedure of the sample. The relative orientation of the domains in the aggregate correspond to the various crystallographically equivalent transformation lattice shears (Chang and Read, J. Metals (N.Y.) 191, 47-52(1951)). If a bending moment is applied to the specimen as it is cooled through the transformation temperature, a deformation is produced which remains substantially the same even upon release of the load. On subsequent heating under various loads, the original cubic structure is recovered, as is likewise the original shape of the specimen which had existed above the transformation temperature. Use has been made of this phenomenon to study the free-energy difference between the two phases as a function of temperature. The various loads applied upon heating the deformed specimen oppose the transformation. Deflection and hence degree of transformation were observed as a function of temperature and the applied load, and thus the transformation temperatures as a function of the external work done by the sample.

5075

Columbia Univ.

RELAXATION PROCESSES IN THE β' PHASE OF THE ALLOY Au Cd. (abstract) D. S. Lieberman, T. A. Read, and L. C. Chang. [nd] 1p. (AECU-1551)

The report is reproduced here in its entirety.

Single crystals of the Au Cd alloy containing 47.5 at. % Cd were grown by the Bridgman method from 99.95% purity gold and 99.99% purity cadmium and were found to have a body-centered cubic structure in the high-temperature phase (Chang and Read, J. Metals (N.Y.) 191, 47-52

(1951)). A diffusionless phase change results in an orthorhombic phase below the transformation temperature.

For certain orientations of the orthorhombic domains in the low-temperatures phase, the specimen exhibits a rubber-like behavior (Olander, Krist. 83A, 145 (1932); Benedicks, Arkiv Mat. Astron. Fysik 27A, No. 18(1940-1941)). Immediately after transformation, however, the specimen is soft and it has been found that the rate of appearance of rubber-like behavior is dependent on the temperatures, the time, and the strains imposed on the specimen. The velocity of sound in the low-temperature phase was also found to exhibit a time-temperature dependence characteristic of diffusion phenomena.

5076

Columbia Univ.

EXPERIMENTAL EVIDENCE OF RELAXATION DURING DIFFUSIONLESS PHASE CHANGES OF SINGLE CRYSTAL BETA Au-Cd ALLOYS CONTAINING 47.5 ATOMIC PERCENT Cd. (abstract) L. C. Chang and T. A. Read. [nd] 1p. (AECU-1552)

The report is reproduced here in its entirety.

The β Au-Cd alloy containing 47.5 at. % Cd (CsCl structure, 2 atoms per unit cell, a_0 = 3.317 kX units) transforms by a diffusionless mechanism to β' (orthorhombic structure, 4 atoms per unit cell, a = 3.148, b = 4.755, c = 4.855 kX units) on cooling to about 60°C and the reverse diffusionless transformation from β' to β takes place when the β' alloy is heated to about 70 to 80°C. The transformation takes place typically in well-annealed crystals by the slow movement of an interface between the two phases from one end of the specimen to the other until transformation is complete. It was found that by holding the interface at a given position of the specimen (on cooling) for a certain length of time t at a given temperature T, the same interface (on reheating at a constant heating rate) stops at exactly the same position for a time interval t' and then proceeds with a jerky motion. Preliminary results show that t' varies both with t and T, suggesting that the relaxation phenomenon is diffusion controlled, for example, by the diffusion of foreign atoms to the interface. More detailed studies of this phenomenon are still in progress.

5077

Illinois Univ.

ON THE ORIENTATIONS OF ZINC CRYSTALS PRODUCED BY THE BRIDGMAN METHOD. L. M. Slifkin. [nd] 3p. (AECU-1559)

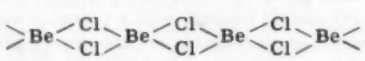
Crucible design is an important factor concerning the distribution of orientations of Zn crystals formed by the Bridgman method. The basal plane was found to be almost always approximately parallel to the direction of the flat section of the crucible. For 10 out of 11 crystals the angle between the basal plane and flat section of the crucible was less than 15°, while random distribution is calculated to give a value of 30°.

5078

Ames Lab.

ELECTRON DEFICIENT COMPOUNDS; (VI) THE STRUCTURE OF BERYLLIUM CHLORIDE. R. E. Rundle and Paul H. Lewis. Aug. 16, 1951. 11p. (ISC-160)

Halogen bridge bonding is studied by means of x-ray analysis of Be chloride, which is isomorphous with dimethylberyllium and silicon disulfide. The orthorhombic unit, a_0 = 9.86, b_0 = 5.36, c_0 = 5.26, contains four $BeCl_2$ molecules. The structure consists of continuous chains:



with an essentially tetrahedral configuration about Be. The Cl-Be-Cl bond angle within the four-membered rings is 98.2° which is less than the tetrahedral angle, as is found in SiS_2, instead of more, as in dimethylberyllium. The bond angles indicate that all bonds in $BeCl_2$ contain an electron pair, so that Cl uses an unshared pair in forming bridge bonds. Hence, chlorides isomorphous with electron deficient metal alkyls are not to be classified as electron deficient compounds. (auth)

5079

Massachusetts Inst. of Tech.

FUNDAMENTALS OF COLD WORKING AND RECRYSTALLIZATION; TECHNICAL PROGRESS REPORT NO. 3, SCOPE III. B. L. Averbach and M. Cohen. Jan. 1, 1951. 3p. (NYO-857)

Progress is reported on attempts to measure the atomic displacements in crystals by means of a new x-ray technique. This x-ray procedure involves a study of the changes in the diffraction-line shapes which occur on plastic deformation and annealing. By a Fourier analysis of these line shapes, it is possible to obtain an indication of the average atomic displacements in each of the important crystallographic directions in a deformed crystal. Single crystal of Cu-2% Si alloy have been rolled in the (110) [112] direction. Prior to rolling, a rocking curve was obtained by means of a double crystal spectrometer using two annealed crystals in the parallel positions. These results were then compared with those obtained by replacing the second crystal with the cold-rolled specimen. This technique measures the range of orientations present within the second crystal.

5080

Sylvania Electric Produets, Inc.

KINETICS AND ORIENTATION RELATIONSHIPS OF SECONDARY RECRYSTALLIZATION IN SILVER. F. D. Rosi, B. H. Alexander, and C. A. Dube. July 31, 1951. 28p. (SEP-71)

This phenomenon of secondary recrystallization in 999.9-fine silver has been investigated in cold-rolled specimens annealed at the temperature of 433 to 533°C. Orientation studies showed that the secondary grains have a preferred orientation which corresponds closely to that of the original deformation texture. Measurements on the growth rate of secondary grains showed that, after an induction period, the rate of growth was invariant with time. Calculated activation energies, describing the temperature dependence of both the visible and invisible growth processes, suggest that the atomic process of crystal growth is one of grain boundary self-diffusion. Under the assumption that grain-boundary mobility is dependent upon boundary energy and curvature, an expression for the growth velocity has been derived, which predicts growth rates in reasonable agreement with measured values. (auth)

5081

Atomic Energy Research Establishment, Harwell, Berks. (England)

NEUTRON CRYSTALLOGRAPHY. J. Thewlis. June 6, 1951. 17p. (AERE G/R-707)

An outline is given of the principles underlying the application of neutron diffraction to crystal analysis. A comparision with x-ray analysis is made, and the similarities and differences between the two are underlined. Ordered scattering amplitudes for x rays and thermal neutrons are tabulated for 46 elements. A short account of the experimental techniques involved is presented, and a survey is made of crystallographic applications up to date. Future developments are then discussed. 38 references.

5082

Army Chemical Center, Md.

CRYSTAL CHEMISTRY OF DEFECTIVE STRUCTURES WITH RESPECT TO RADIATION, paper 5 of REPORT OF SYMPOSIUM IV; CHEMISTRY AND PHYSICS OF RADIATION DOSIMETRY [HELD AT THE] ARMY CHEMICAL CENTER 18, 19, and 20 SEPTEMBER 1950; PART I - UNCLASSIFIED PAPERS. W. A. Weyl. [nd] 13p. (NP-3237(paper 5))

The interaction of radiant energy and solid matter is discussed in some detail. The reasons for the failure of classical crystal chemistry in respect to radiation phenomena and the possible application of crystal chemistry to defective structures has been considered. Surfaces and foreign atoms play a decisive role concerning the interaction of solids and radiant energy. Not only are the parameters used in defining a crystal invalid when applied to surfaces or impurities but even the apparently fundamental properties of ions, namely, their size, charge, and polarizabilities, undergo considerable changes when they are brought into the force fields of surfaces or into the neighborhood of lattice vacancies. This relationship between the properties of ions and their environment makes it difficult to predict their response to radiation. However, defective structures can be made useful for developing devices for detecting radiation. As many electronic processes are based on the migration of electrons through a crystal or a glass, the electronic conductivity of insulating materials is discussed from a crystal chemical point of view.

5083

PRECISE DETERMINATION OF LATTICE CONSTANTS BY ELECTRON DIFFRACTION AND VARIATIONS IN THE LATTICE CONSTANTS OF VERY SMALL CRYSTALLITES. F. W. C. Boswell. Proc. Phys. Soc. (London) 64A, 465-76 (1951) May.

The lattice constants of several alkali halides have been determined by electron diffraction to a higher accuracy than had previously been attained. The x-ray value of the lattice constant of TlCl was used as a standard reference. The lattice constants of 6 alkali halides, with crystal sizes greater than 150 A, were found to agree with x-ray values to within the experimental error of 0.05%. It was shown that for crystal sizes less than 100 A the lattice constants of the alkali halides were found to be less than the x-ray values by an amount dependent on crystal size. For a crystal size of about 30 A the decrease was approximately 0.5%. Similar determinations on evaporated gold films showed that, for a crystal size of about 20 A, the decrease in the lattice constant was almost 2%. For a crystal size of 40 A, the largest obtained, the lattice constant was 0.2% less than the x-ray value. Evaporated films of silver and bismuth also were found to have lattice constants less than the x-ray values. It can therefore be concluded that previous reports of an increase of the lattice constants of alkali halides with decreasing crystal sizes are in error. (auth)

DEUTERIUM AND DEUTERIUM COMPOUNDS

5084

Los Alamos Scientific Lab.

MOLAR VOLUMES OF DEUTERIUM AND OF A DEUTERIUM-TRITIUM MIXTURE BETWEEN 19.5 AND 24.5° K. Eugene C. Kerr. Jan. 22, 1951. Decl. Aug. 1, 1951. 8p. (AECD-3211; LADC-999)

The molar volumes of deuterium and of a 1:1 atom ratio mixture of deuterium and tritium have been measured in the temperature range of 19.5 to 24.5°K. The equation V_M (cm^3/mole) = 20.188 + 0.03587T + 0.006565T^2 represents the combined data of this research and of earlier measurements in the range 18.7 to 20.5°K by Clusius and Bartholemé. The data for the tritium-deuterium mixture may be represented by: V_M (cm^3/mole) = 18.155 + 0.1294T + 0.004203T^2. (auth)

5085

Brookhaven National Lab. and Princeton Univ.

BEHAVIOR OF PARAFFIN HYDROCARBONS ON ELECTRON IMPACT; SYNTHESIS AND MASS SPECTRA OF SOME DEUTERATED PARAFFIN HYDROCARBONS. D. O. Schissler, S. O. Thompson, and John Turkevich. [nd] 18p. (AECU-1387)

A method of preparation of mono-, di-, and trideutero paraffin hydrocarbons containing the deuterium on one carbon atom is described. The mass spectra are given for all the deuterated methanes, for the deuterated ethanes C_2H_5D, CH_3CHD_2, CH_3CD_3, C_2D_6, and for the deuterated propanes C_3H_7D-2d_1 and $C_3H_6D_2$-2d_2. A quantitative explanation is given for the mass spectra of the deuterated methanes.

FLUORINE AND FLUORINE COMPOUNDS

5086

Oklahoma Univ.

SPECTROSCOPIC PROPERTIES OF FLUOROCARBONS AND FLUORINATED HYDROCARBONS. J. Rud Nielsen. June 15, 1951. 38p. (ORO-40)

New Raman-spectral data are presented for the following compounds: 1,1-difluoro-1-chloroethane, 1,1-dichloro-1-fluoroethane, 1,1,1-trichloroethane, 1,1-difluorethane, monofluoroethane, monochloropentafluoroethane, 1,1-dichlorotetrafluoroethane, meta-difluorobenzene, and 1,2-dichlorohexafluorocyclobutane. On the basis of these data, and the infrared spectra obtained at the Naval Research Laboratory, complete assignments of fundamental molecular vibration frequencies are made for the first-mentioned three ethane derivatives, and thermodynamic functions are tabulated. Complete assignment of fundamentals has also been made for $CFH_2{\cdot}CH_3$. For the remaining three substituted ethanes all fundamentals except the torsional frequency have been determined.

5087

ACTION OF ALCOHOLS ON 3,3,4,4-TETRAFLUORO-1,2-DICHLOROCYCLOBUTENE-1. J. D. Park, C. M. Snow, and J. R. Lacher. J. Am. Chem. Soc. 73, 2342-5(1951) May.

The reaction of alkanols with 3,3,4,4-tetrafluoro-1,2-dichlorocyclobutene-1 in the presence of a base under control conditions results in the formation of 1-alkoxy-2-chloro-3,3,4,4-tetrafluorocyclobutene-1, as contrasted to the production of 1,2-dialkoxy-3,3,4,4-tetrafluorocyclobutene-1 from the analogous hexafluorocyclobutene reported previously. When an excess of alcoholic alkali solution was used with 3,3,4,4-tetrafluoro-1,2-dichlorocyclobutene-1, a cyclic triether having the empirical formula $C_4F_2Cl(OR)_3$ was formed. Various mechanisms are discussed. Some of the physical properties of the ethers including magnetic susceptibilities, along with their ultraviolet and infrared absorption spectra, are presented. (auth)

5088

SUBSTITUTED METHANES. VI. FORCE CONSTANTS AND CALCULATED THERMODYNAMIC PROPERTIES FOR SOME TRIFLUOROMETHANES. Charlotte E. Decker, Arnold G. Meister, and Forrest F. Cleveland. J. Chem. Phys. 19, 784-8(1951) June.

Using previous Raman and infrared data, force constants were calculated for CF_4, CF_3H, and CF_3Cl, by means of the Wilson FG matrix method, with a potential energy function containing all possible second-degree terms. Fundamental frequencies for CF_3D were then determined by means of the force constants found for CF_3H. Finally,

the heat content, free energy, entropy, and heat capacity for the ideal gaseous state at 1 atm pressure were calculated for these 4 molecules for 11 temperatures, from 100 to 1000°K, with a rigid rotator, harmonic oscillator approximation. (auth)

GRAPHITE

5089

Argonne National Lab.

THE PROPERTIES OF THE INTERSTITIAL COMPOUNDS OF GRAPHITE; II. THE STRUCTURE AND STABILITY OF GRAPHITE RESIDUE COMPOUNDS. Gerhart Hennig. June 28, 1951. 14p. (ANL-4645)

Controlled decomposition of lamellar compounds of graphite produces substances intermediate in composition between graphite and lamellar compounds. These intermediate compounds have been termed residue compounds. They are much more resistant to decomposition than the lamellar compounds. The x-ray pattern of residue compounds shows a very slight increase in the c spacing of the graphite lattice. The increase is entirely insufficient to account for the trapped reactant. Consequently, the bulk of the trapped reactant is believed to be situated at crystal imperfections. Quantitative studies of the composition of graphite bromide residue compounds have shown that their composition is strongly dependent on the type subdivision of the graphite used and the temperature to which the compounds have been heated. (auth)

LABORATORIES AND EQUIPMENT

5090

Radiation Lab., Univ. of Calif.

A FILTRATION STUDY OF A SPARK GENERATED AEROSOL OF THE TRANSPLUTONIUM ELEMENTS. J. G. Conway, G. T. Saunders, and M. F. Moore. June 7, 1951. Decl. July 30, 1951. 9p. (AECD-3221; UCRL-1355)

A description is given of a closed-system type filter train which was developed for protection against the radioactive aerosol produced by sparking in spectrographic analysis of transplutonium elements. Samples in the range 1 to 50 μg with an activity level of $\sim 10^8$ cpm were involved. The equipment is described and diagramed, and report is made of analytical experiments performed to test it. Incorporated into the filter system are check points that are utilized to establish a material balance within the train. The final check point, an evacuated cylinder, shows that 1 part in 10^{10} passes through the filtering train.

5091

Argonne National Lab.

A GLASS PRESSURE VESSEL WITH HEATING JACKET. John H. Pomeroy. June 1951. 5p. (AECU-1471; UAC-401)

A glass and stainless-steel pressure vessel for use at pressures up to 4 atm and temperatures up to 150° is described. It is simple to build and use and possesses the extra advantage that its glass construction enables the chemist to observe the course of the reaction with convenience and safety. It has been used for catalytic hydrogenation when mounted on a variable-speed shaker, and it may be used for polymerization under pressure to minimize bubble formation. For convenience in handling small amounts of material, such as may be found in tracer syntheses, a centrifuge tube in a stainless-steel carrier may be used as an insert or liner.

5092

Carbide and Carbon Chemicals Co., K-25

REMOVABLE BOWL COLD TRAP. E. C. Evans and E. F. Babelay. Aug. 13, 1951. 4p. (K-799)

A removable bowl type cold trap which can be attached to vacuum systems by means of gaskets is described. Desirable features of this trap are ease of replacement, economy, and low breakage rate.

5093

Oak Ridge National Lab.

SURFACE FINISH SPECIFICATIONS AT OAK RIDGE NATIONAL LABORATORY. J. J. Wallace and F. Ring, Jr. July 24, 1951. 13p. (ORNL-1051)

5094

Isotopes Div., AEC

DESIGN OF SMALL-SCALE RADIOCHEMICAL LABORATORIES, paper 13 of HEALTH PHYSICS INSURANCE SEMINAR; [FEBRUARY 6–10, 1950]. George G. Manov. Mar. 12, 1951. 17p. (TID-388(paper 13))

The design of radiochemical laboratories is examined from the viewpoints of the nature of the work to be done, the quantities and kinds of radioisotopes to be employed, and the radiation hazards likely to be encountered. Ninety per cent of the isotope shipments are composed of short-lived materials such as I^{131} and P^{32}, most of which are used in medicine. The combination of short-lived materials and medical application accounts for the isotope programs in approximately one-half the total laboratories now using radioactive materials. In such cases, a one-room or preferably a two-room laboratory equipped with a moderate amount of Pb shielding, remote-control pipetting, equipment, etc., is satisfactory. The proper design of laboratories for various levels of activity is shown by photographs of a series of scale models. 11 figures.

5095

Radiation Lab., Univ. of California

THE SPECTROGRAPHIC ANALYSIS OF RADIOACTIVE MATERIALS. John G. Conway and Milton F. Moore. Feb. 23, 1951. 11p. (UCRL-1138)

A convenient and flexible arc-spark chamber has been built and mounted in gloved boxes to be used in the spectrochemical analysis of α-active elements. Tests indicate that the radioactivity released during use of the equipment is efficiently removed by the accompanying filter system. 3 photographs. (auth)

MOLECULAR STRUCTURE

5096

Iowa State Coll.

THE EFFECT OF VARIATION OF Z UPON THE THEORETICALLY COMPUTED ENERGY LEVELS OF BENZENE. Harrison Shull and Frank O. Ellison. [nd] 5p. (AECU-1453)

In the Mayer-Sklar approximation method (J. Chem. Phys. 6, 645(1938)) for finding energies of lower excited levels of benzene by antisymmetrized products of molecular orbitals, the skeletal C-C distance and effective nuclear charge Z are the only two nontheoretical parameters. The former is here taken as 1.40 A and the level energies are calculated for Z = 2.268, 2.740, and 3.180. It was found necessary to include all 3- and 4-center integrals in the calculations. Results only are given and confirm the prediction of B_{1u} and B_{2u} for the lowest triplet and lowest excited singlet states.

5097

Carbide and Carbon Chemicals Co., K-25

STUDIES IN MOLECULAR STRUCTURE. Dale Winston Magnuson. July 27, 1951. 118p. (K-787)

Apparatus have been developed for the determination of dielectric constants at 9400 Mc. The dielectric constant of UF_6 was determined and the molar polarization was to be 31.453 cc. The dipole moment was calculated to be less than 0.10 Debye unit. A zero dipole moment is in agreement with the interpretation of the infrared and Raman spectra which is based on a regular octahedron structure for the UF_6 molecule. The dielectric constant of chlorine trifluoride

5082

Army Chemical Center, Md.

CRYSTAL CHEMISTRY OF DEFECTIVE STRUCTURES WITH RESPECT TO RADIATION, paper 5 of REPORT OF SYMPOSIUM IV; CHEMISTRY AND PHYSICS OF RADIATION DOSIMETRY [HELD AT THE] ARMY CHEMICAL CENTER 18, 19, and 20 SEPTEMBER 1950; PART I - UNCLASSIFIED PAPERS. W. A. Weyl. [nd] 13p. (NP-3237(paper 5))

The interaction of radiant energy and solid matter is discussed in some detail. The reasons for the failure of classical crystal chemistry in respect to radiation phenomena and the possible application of crystal chemistry to defective structures has been considered. Surfaces and foreign atoms play a decisive role concerning the interaction of solids and radiant energy. Not only are the parameters used in defining a crystal invalid when applied to surfaces or impurities but even the apparently fundamental properties of ions, namely, their size, charge, and polarizabilities, undergo considerable changes when they are brought into the force fields of surfaces or into the neighborhood of lattice vacancies. This relationship between the properties of ions and their environment makes it difficult to predict their response to radiation. However, defective structures can be made useful for developing devices for detecting radiation. As many electronic processes are based on the migration of electrons through a crystal or a glass, the electronic conductivity of insulating materials is discussed from a crystal chemical point of view.

5083

PRECISE DETERMINATION OF LATTICE CONSTANTS BY ELECTRON DIFFRACTION AND VARIATIONS IN THE LATTICE CONSTANTS OF VERY SMALL CRYSTALLITES. F. W. C. Boswell. Proc. Phys. Soc. (London) 64A, 465-76 (1951) May.

The lattice constants of several alkali halides have been determined by electron diffraction to a higher accuracy than had previously been attained. The x-ray value of the lattice constant of TlCl was used as a standard reference. The lattice constants of 6 alkali halides, with crystal sizes greater than 150 A, were found to agree with x-ray values to within the experimental error of 0.05%. It was shown that for crystal sizes less than 100 A the lattice constants of the alkali halides were found to be less than the x-ray values by an amount dependent on crystal size. For a crystal size of about 30 A the decrease was approximately 0.5%. Similar determinations on evaporated gold films showed that, for a crystal size of about 20 A, the decrease in the lattice constant was almost 2%. For a crystal size of 40 A, the largest obtained, the lattice constant was 0.2% less than the x-ray value. Evaporated films of silver and bismuth also were found to have lattice constants less than the x-ray values. It can therefore be concluded that previous reports of an increase of the lattice constants of alkali halides with decreasing crystal sizes are in error. (auth)

DEUTERIUM AND DEUTERIUM COMPOUNDS

5084

Los Alamos Scientific Lab.

MOLAR VOLUMES OF DEUTERIUM AND OF A DEUTERIUM-TRITIUM MIXTURE BETWEEN 19.5 AND 24.5° K. Eugene C. Kerr. Jan. 22, 1951. Decl. Aug. 1, 1951. 8p. (AECD-3211; LADC-999)

The molar volumes of deuterium and of a 1:1 atom ratio mixture of deuterium and tritium have been measured in the temperature range of 19.5 to 24.5°K. The equation V_M (cm^3/mole) = 20.188 + 0.03587T + 0.006565T^2 represents the combined data of this research and of earlier measurements in the range 18.7 to 20.5°K by Clusius and Bartholemé. The data for the tritium-deuterium mixture may be represented by: V_M (cm^3/mole) = 18.155 + 0.1294T + 0.004203T^2. (auth)

5085

Brookhaven National Lab. and Princeton Univ.

BEHAVIOR OF PARAFFIN HYDROCARBONS ON ELECTRON IMPACT; SYNTHESIS AND MASS SPECTRA OF SOME DEUTERATED PARAFFIN HYDROCARBONS. D. O. Schissler, S. O. Thompson, and John Turkevich. [nd] 18p. (AECU-1387)

A method of preparation of mono-, di-, and trideutero paraffin hydrocarbons containing the deuterium on one carbon atom is described. The mass spectra are given for all the deuterated methanes, for the deuterated ethanes C_2H_5D, CH_3CHD_2, CH_3CD_3, C_2D_6, and for the deuterated propanes C_3H_7D-2d_1 and $C_3H_6D_2$-2d_2. A quantitative explanation is given for the mass spectra of the deuterated methanes.

FLUORINE AND FLUORINE COMPOUNDS

5086

Oklahoma Univ.

SPECTROSCOPIC PROPERTIES OF FLUOROCARBONS AND FLUORINATED HYDROCARBONS. J. Rud Nielsen. June 15, 1951. 38p. (ORO-40)

New Raman-spectral data are presented for the following compounds: 1,1-difluoro-1-chloroethane, 1,1-dichloro-1-fluoroethane, 1,1,1-trichloroethane, 1,1-difluorethane, monofluoroethane, monochloropentafluoroethane, 1,1-dichlorotetrafluoroethane, meta-difluorobenzene, and 1,2-dichlorohexafluorocyclobutane. On the basis of these data, and the infrared spectra obtained at the Naval Research Laboratory, complete assignments of fundamental molecular vibration frequencies are made for the first-mentioned three ethane derivatives, and thermodynamic functions are tabulated. Complete assignment of fundamentals has also been made for CFH_2·CH_3. For the remaining three substituted ethanes all fundamentals except the torsional frequency have been determined.

5087

ACTION OF ALCOHOLS ON 3,3,4,4-TETRAFLUORO-1,2-DICHLOROCYCLOBUTENE-1. J. D. Park, C. M. Snow, and J. R. Lacher. J. Am. Chem. Soc. 73, 2342-5(1951) May.

The reaction of alkanols with 3,3,4,4-tetrafluoro-1,2-dichlorocyclobutene-1 in the presence of a base under control conditions results in the formation of 1-alkoxy-2-chloro-3,3,4,4-tetrafluorocyclobutene-1, as contrasted to the production of 1,2-dialkoxy-3,3,4,4-tetrafluorocyclobutene-1 from the analogous hexafluorocyclobutene reported previously. When an excess of alcoholic alkali solution was used with 3,3,4,4-tetrafluoro-1,2-dichlorocyclobutene-1, a cyclic triether having the empirical formula $C_4F_2Cl(OR)_3$ was formed. Various mechanisms are discussed. Some of the physical properties of the ethers including magnetic susceptibilities, along with their ultraviolet and infrared absorption spectra, are presented. (auth)

5088

SUBSTITUTED METHANES. VI. FORCE CONSTANTS AND CALCULATED THERMODYNAMIC PROPERTIES FOR SOME TRIFLUOROMETHANES. Charlotte E. Decker, Arnold G. Meister, and Forrest F. Cleveland. J. Chem. Phys. 19, 784-8(1951) June.

Using previous Raman and infrared data, force constants were calculated for CF_4, CF_3H, and CF_3Cl, by means of the Wilson FG matrix method, with a potential energy function containing all possible second-degree terms. Fundamental frequencies for CF_3D were then determined by means of the force constants found for CF_3H. Finally,

the heat content, free energy, entropy, and heat capacity for the ideal gaseous state at 1 atm pressure were calculated for these 4 molecules for 11 temperatures, from 100 to 1000°K, with a rigid rotator, harmonic oscillator approximation. (auth)

GRAPHITE

5089

Argonne National Lab.

THE PROPERTIES OF THE INTERSTITIAL COMPOUNDS OF GRAPHITE; II. THE STRUCTURE AND STABILITY OF GRAPHITE RESIDUE COMPOUNDS. Gerhart Hennig. June 28, 1951. 14p. (ANL-4645)

Controlled decomposition of lamellar compounds of graphite produces substances intermediate in composition between graphite and lamellar compounds. These intermediate compounds have been termed residue compounds. They are much more resistant to decomposition than the lamellar compounds. The x-ray pattern of residue compounds shows a very slight increase in the c spacing of the graphite lattice. The increase is entirely insufficient to account for the trapped reactant. Consequently, the bulk of the trapped reactant is believed to be situated at crystal imperfections. Quantitative studies of the composition of graphite bromide residue compounds have shown that their composition is strongly dependent on the type subdivision of the graphite used and the temperature to which the compounds have been heated. (auth)

LABORATORIES AND EQUIPMENT

5090

Radiation Lab., Univ. of Calif.

A FILTRATION STUDY OF A SPARK GENERATED AEROSOL OF THE TRANSPLUTONIUM ELEMENTS. J. G. Conway, G. T. Saunders, and M. F. Moore. June 7, 1951. Decl. July 30, 1951. 9p. (AECD-3221; UCRL-1355)

A description is given of a closed-system type filter train which was developed for protection against the radioactive aerosol produced by sparking in spectrographic analysis of transplutonium elements. Samples in the range 1 to 50 μg with an activity level of $\sim 10^8$ cpm were involved. The equipment is described and diagramed, and report is made of analytical experiments performed to test it. Incorporated into the filter system are check points that are utilized to establish a material balance within the train. The final check point, an evacuated cylinder, shows that 1 part in 10^{10} passes through the filtering train.

5091

Argonne National Lab.

A GLASS PRESSURE VESSEL WITH HEATING JACKET. John H. Pomeroy. June 1951. 5p. (AECU-1471; UAC-401)

A glass and stainless-steel pressure vessel for use at pressures up to 4 atm and temperatures up to 150° is described. It is simple to build and use and possesses the extra advantage that its glass construction enables the chemist to observe the course of the reaction with convenience and safety. It has been used for catalytic hydrogenation when mounted on a variable-speed shaker, and it may be used for polymerization under pressure to minimize bubble formation. For convenience in handling small amounts of material, such as may be found in tracer syntheses, a centrifuge tube in a stainless-steel carrier may be used as an insert or liner.

5092

Carbide and Carbon Chemicals Co., K-25

REMOVABLE BOWL COLD TRAP. E. C. Evans and E. F. Babelay. Aug. 13, 1951. 4p. (K-799)

A removable bowl type cold trap which can be attached to vacuum systems by means of gaskets is described. Desirable features of this trap are ease of replacement, economy, and low breakage rate.

5093

Oak Ridge National Lab.

SURFACE FINISH SPECIFICATIONS AT OAK RIDGE NATIONAL LABORATORY. J. J. Wallace and F. Ring, Jr. July 24, 1951. 13p. (ORNL-1051)

5094

Isotopes Div., AEC

DESIGN OF SMALL-SCALE RADIOCHEMICAL LABORATORIES, paper 13 of HEALTH PHYSICS INSURANCE SEMINAR; [FEBRUARY 6–10, 1950]. George G. Manov. Mar. 12, 1951. 17p. (TID-388(paper 13))

The design of radiochemical laboratories is examined from the viewpoints of the nature of the work to be done, the quantities and kinds of radioisotopes to be employed, and the radiation hazards likely to be encountered. Ninety per cent of the isotope shipments are composed of short-lived materials such as I^{131} and P^{32}, most of which are used in medicine. The combination of short-lived materials and medical application accounts for the isotope programs in approximately one-half the total laboratories now using radioactive materials. In such cases, a one-room or preferably a two-room laboratory equipped with a moderate amount of Pb shielding, remote-control pipetting, equipment, etc., is satisfactory. The proper design of laboratories for various levels of activity is shown by photographs of a series of scale models. 11 figures.

5095

Radiation Lab., Univ. of California

THE SPECTROGRAPHIC ANALYSIS OF RADIOACTIVE MATERIALS. John G. Conway and Milton F. Moore. Feb. 23, 1951. 11p. (UCRL-1138)

A convenient and flexible arc-spark chamber has been built and mounted in gloved boxes to be used in the spectrochemical analysis of α-active elements. Tests indicate that the radioactivity released during use of the equipment is efficiently removed by the accompanying filter system. 3 photographs. (auth)

MOLECULAR STRUCTURE

5096

Iowa State Coll.

THE EFFECT OF VARIATION OF Z UPON THE THEORETICALLY COMPUTED ENERGY LEVELS OF BENZENE. Harrison Shull and Frank O. Ellison. [nd] 5p. (AECU-1453)

In the Mayer-Sklar approximation method (J. Chem. Phys. 6, 645(1938)) for finding energies of lower excited levels of benzene by antisymmetrized products of molecular orbitals, the skeletal C-C distance and effective nuclear charge Z are the only two nontheoretical parameters. The former is here taken as 1.40 A and the level energies are calculated for Z = 2.268, 2.740, and 3.180. It was found necessary to include all 3- and 4-center integrals in the calculations. Results only are given and confirm the prediction of B_{1u} and B_{2u} for the lowest triplet and lowest excited singlet states.

5097

Carbide and Carbon Chemicals Co., K-25

STUDIES IN MOLECULAR STRUCTURE. Dale Winston Magnuson. July 27, 1951. 118p. (K-787)

Apparatus have been developed for the determination of dielectric constants at 9400 Mc. The dielectric constant of UF_6 was determined and the molar polarization was to be 31.453 cc. The dipole moment was calculated to be less than 0.10 Debye unit. A zero dipole moment is in agreement with the interpretation of the infrared and Raman spectra which is based on a regular octahedron structure for the UF_6 molecule. The dielectric constant of chlorine trifluoride

was determined in the same apparatus. The temperature dependence of the monomer molar polarization was used to calculate the dipole moment which was 0.554 Debye unit. The molar polarization was found to be 15.944 + 1882.0/T°K cc. The dimer molar polarization was determined to be 49.8 cc, assuming no dipole moment. From the probable errors, a dipole moment as large as 0.62 Debye unit was not inconsistent with the data. Analysis of the rotational structure of the infrared bands in nitrosyl fluoride showed that this molecule was nearly a prolate symmetric top rotator. On the basis of symmetric top theory, rotational parameters were calculated. From positively identified lines in the microwave spectrum of nitrosyl fluoride, the reciprocal moments of inertia were calculated; A = 95,191.73 Mc, B = 11,843.91 Mc, and C = 10,508.45 Mc. The asymmetry parameter was found to be −0.968460. The principal moments of inertia were also calculated: I_a = 8.81345×10^{-40} g cm², I_b = 70.8354×10^{-40} g cm², and I_c = 79.8375×10^{-40} g cm². The inertial defect was 0.1886×10^{-40} g cm². Using one line of the isotopic N^{15} molecule in addition to the moments of inertia, the molecular configuration of nitrosyl fluoride was determined: r_{NO} = 1.13 A, r_{NF} = 1.52 A, and ∠ONF = 110.2°. The dipole moment components along I_a and I_b, μ_a and μ_b were determined from the observed Stark shift on two lines: μ_a 1.70 Debye units, μ_b 0.62 Debye unit, and the total dipole moment 1.81 Debye units.

5098

Cornell Univ.

THE STRUCTURE OF B-TRICHLOROBORAZOLE. D. L. Coursen and J. L. Hoard. July 1, 1951. 30p. (NYO-718)

Analysis of the x-ray diffraction data obtained from single crystals of B-trichloroborazole has led to a complete determination of structure. Three-dimensional Fourier methods including corrections for finite termination of series were used to give accurate values of the atomic coordinates. The molecular configuration of B-trichloroborazole closely resembles that of sym-trichlorobenzene. Bond distances and interbond angles for the B-trichloroborazole molecules of symmetry D_{3h} are B-N = 1.413 ± 0.010 A; B-Cl = 1.760 ± 0.015 A; ∠NBN = 119 ± 1°; ∠BNB = 121 ± 1°. (auth)

RADIATION CHEMISTRY

5099

Argonne National Lab.

THE EFFECTS OF IONIZING RADIATIONS ON LIQUIDS. Sheffield Gordon, E. J. Hart, and P. D. Walsh. Dec. 1950. 14p. (AECU-1534; UAC-406)

As part of a detailed study of the mechanism of oxidation of formic acid by γ rays in dilute aqueous solution, a method for measuring the proportion of radicals undergoing recombination and those available for reaction with formic acid is described. The course of oxidation of formic acid by γ rays in aqueous solutions containing H_2O_2 and O is discussed. The effect of treatment of cells and purity of water on the decomposition of H_2O_2 by γ rays has been investigated. A plot shows the effect of pH on the γ ray induced isotopic exchange between deuterium gas dissolved in light water and the water. The oxidation of ferrous sulfate by the β's from tritium disintegration has been studied.

5100

Army Chemical Center, Md.

REPORT OF SYMPOSIUM IV; CHEMISTRY AND PHYSICS OF RADIATION DOSIMETRY [HELD AT THE] ARMY CHEMICAL CENTER 18, 19, and 20 SEPTEMBER 1950; PART I—UNCLASSIFIED PAPERS. George B. Wilson, Chairman. [nd] 188p. (NP-3237)

Separate abstracts have been prepared on the following sections of this report: Review of the Chemical Effects of Ionizing Radiation, paper 1; Mechanism of Radiation Chemical Reactions in Organic and in Aquo-organic Systems, paper 2; Solvent Activated Radiation Reactions in Aqueous Solutions, paper 3; Theory of Radiation Chemistry, I. Some Chemical Effects of Variation of Ionization Density, paper 4; Crystal Chemistry of Defective Structures with Respect to Radiation, paper 5; Luminescent Solids (Phosphors), paper 6; Effect of Radiation on Colloidal and High Polymeric Substances, paper 7; Thermoluminescence and Related Properties of Crystals, paper 8; and The UCLA Dosimeter, Its Recent Modifications and Additional Applications, paper 9.

RADIATION EFFECTS

5101

Brookhaven National Lab.

DECOMPOSITION OF HYDROGEN PEROXIDE BY HIGH ENERGY X-RAYS. Everett R. Johnson. [nd] 4p. (AECU-1424)

Deaerated, unbuffered solutions of H_2O_2 were irradiated with x rays from a 2-Mev Van de Graaff generator. The decomposition was studied by both gas and spectrophotometric analyses. Over the concentration range investigated (1×10^{-4} M to 12.4×10^{-3} M H_2O_2) the decomposition yield was proportional to the square root of the initial peroxide concentration. The initial slope of the H_2 yield from irradiation decomposition of H_2O_2 solutions is identical with that found by irradiating unbuffered KI, KBr, and KI + H_2O_2 solutions. The H_2 evolved is believed to arise from the solvent and not from the H_2O_2. For a dilute H_2O_2 solution (95μM) the H_2 yield is decreased after a dose of 10,000 r, owing possibly to competition between the solvent decomposition products (H_2 + O_2 or H_2O_2) and the H_2O_2 for free radicals (back reaction). The decomposition of 3.9×10^{-4} H_2O_2 solution was found to be independent of intensity in the range 3 to 38.7 r/sec, but below this value the decomposition yield increased with decreasing intensity.

5102

Wisconsin Univ.

EVIDENCE ON THE ELEMENTARY REACTIONS OF HALOGENS ACTIVATED BY NUCLEAR PROCESSES IN ETHYL HALIDES AND IN HYDROCARBONS. Sulamith Goldhaber and John E. Willard. [nd] 14p. (AECU-1505)

The organic yields of the radiative neutron-capture reactions of the halogens in purified ethyl halides have been determined in the liquid and solid state, in the presence of thermal atom scavengers, and in hydrocarbon solvents. Among the important results are: (1) the organic yield of the iodide is the same in the solid phase as in the liquid phase whereas the yields of the bromide and chloride are much higher in the solid; (2) both the organic and inorganic yields of the bromide (and possibly also the iodide and chloride) are due in part to hot processes and in part to thermal processes; (3) the organic yields decrease in the order iodide, bromide, chloride; (4) the organic yields of the bromide and iodide increase with dilution with hexane; (5) the organic yields of dilute solutions of I or ethyl iodide appear to increase with increasing chain length of the hydrocarbon solvent from pentane to octane. The results have been interpreted in terms of the relative probability of nine possible competing types of elementary reactions. It is suggested that the density of radical production in the volume element where the tagged atom loses its energy may be a controlling factor in some cases and that the activation energy for thermal reaction with molecules of the medium may be so in other cases. (auth)

5103
Brookhaven National Lab.
DECOMPOSITION OF WATER, DILUTE HALIDE SOLUTIONS, [AND H_2O_2 BY HIGH ENERGY X-RAYS], p. 59-61 of QUARTERLY PROGRESS REPORT; JANUARY 1–MARCH 31, 1951. E. R. Johnson and A. O. Allen. June 1951. 2p. (BNL-103(p.59-61))

A better material balance has been obtained in experiments on decomposition to H_2 and O_2 of dilute KBr and KI solutions under the action of x rays by a slight change in the degassing prodedure. CO_2 has been found in amounts accounting for the O_2 deficit. At high dosages ((75 to 100) × 10^5 r) the O_2 yield leveled off and H_2O_2 concentration reached about 20 to 25 μ moles/liter. The rate of decomposition of H_2O_2 as a function of concentration in the presence of 10^{-4} M KI is 2.43 times that in the absence of iodide ion. There is an intensity effect on the decomposition of H_2O_2 for low intensities (below 4000 r/hr), the yield increasing with decreasing intensity, but decomposition is relatively independent of intensity at higher rates.

5104
Radiation Lab., Univ. of Calif.
REDUCTION OF CARBON DIOXIDE IN AQUEOUS SOLUTIONS BY IONIZING RADIATION. W. M. Garrison, D. C. Morrison, J. G. Hamilton, A. A. Benson, and M. Calvin. Mar. 13, 1951. 10p. (UCRL-1192)

Appreciable quantities of CO_2 were reduced to formic acid by means of water through the agency of He-ion bombardment. The general technique employed in this investigation was to bombard air-free aqueous solutions of C^{14}-labeled CO_2 in a closed system with and without the addition of ferrous sulfate. Whether or not the resulting formic acid is further reduced to formaldehyde or whether formaldehyde has its origin in a direct reduction of carbon dioxide still remains to be demonstrated, but formaldehyde can also be produced from carbon dioxide and water under the influence of radiation.

5105
Radiation Lab., Univ. of Calif.
THE INFLUENCE OF THE DENSITY OF IONIZATION ON THE DECOMPOSITION OF WATER AND BIOLOGICAL SURVIVAL. William J. Toulis. June 21, 1951. 21p. (UCRL-1332)

The degree of decomposition in a series of samples of water bombarded with 20-Mev alphas is reported. The degree of decomposition in each sample was measured in terms of the H_2O_2 decomposition yield. Results of these measurements, and experimental results with protons from a previous investigation, are presented in graph form. Parallelisms that seem to exist between observations of the decomposition products of water, H, OH, HO_2 and H_2O_2, as a function of the density of ionization and the rate of energy loss and many biological results under similar circumstances are discussed.

5106
Radiation Lab., Univ. of Calif.
CHEMICAL PRODUCTS OF THE IRRADIATION OF ALIPHATIC ALCOHOLS WITH HIGH ENERGY NUCLEAR PARTICLES. William R. McDonell. July 6, 1951. 125p. (UCRL-1378)

The yields of primary chemical products of the irradiation of methyl, ethyl, n-propyl, iso-propyl, n-butyl, isobutyl, sec-butyl, tert-butyl, n-octyl, and n-decyl alcohols with 27-Mev He ions have been determined. The major products detected were hydrogen, hydrocarbons, carbonyl compounds, glycols, and water. Their respective structures and yields establish that the radiolysis products of the simple alcohols result principally from reactions which involve those groups bonded to the carbon of the functional carbinol group. The radiolytic reactions are not chain reactions. A résumé of analytical procedures, a stoichiometrical correlation of product yields, and a discussion of possible mechanisms for the reactions are given.

5107
Army Chemical Center, Md.
REVIEW OF THE CHEMICAL EFFECTS OF IONIZING RADIATION, paper 1 of REPORT OF SYMPOSIUM IV; CHEMISTRY AND PHYSICS OF RADIATION DOSIMETRY [HELD AT THE] ARMY CHEMICAL CENTER 18, 19, and 20 SEPTEMBER 1950; PART I–UNCLASSIFIED PAPERS. S. C. Lind. [nd] 8p. (NP-3237(paper 1))

A historical review is given of the contributions of various investigators leading to the advancement of radiation chemistry to its present status. 22 references.

5108
Army Chemical Center, Md.
MECHANISM OF RADIATION CHEMICAL REACTIONS IN ORGANIC AND IN AQUO-ORGANIC SYSTEMS, paper 2 of REPORT OF SYMPOSIUM IV; CHEMISTRY AND PHYSICS OF RADIATION DOSIMETRY [HELD AT THE] ARMY CHEMICAL CENTER 18, 19, and 20 SEPTEMBER 1950; PART I–UNCLASSIFIED PAPERS. Milton Burton. [nd] 12p. (NP-3237(paper 2))

The ionization process in radiation chemistry is not unique; some such processes lead to excited molecules and others culminate in dissociation before neutralization. Unless the ions dissociate in the act of formation or shortly thereafter, the only ionic species surviving long enough to be neutralized will be those of lowest potential. Applicability of this fact to the radiation chemistry of mixtures is discussed with particular reference to the system benzene-cyclohexane. In the liquid mixture, benzene protects the cyclohexane. On the other hand, in closely coupled systems phenomena akin to photosensitization can occur. Benzene is known to photosensitize decomposition of ethyl iodide. Data here quoted show that the benzene ring not only protects the side chain in alkyl benzenes but to a degree sensitizes its decomposition. In aqueous systems, reactions of importance include not only direct free radical formation in the water but also indirect effects resultant from the capture by the water of electrons emitted primarily from the organic constituent. The resultant effects in aquo-organic systems are shown to be highly dependent on the degree of dispersion of the water that may be present as solvent, dispersed molecular aggregates, or isolated molecules. (auth)
22 references.

5109
Army Chemical Center, Md.
SOLVENT ACTIVATED RADIATION REACTIONS IN AQUEOUS SOLUTIONS, paper 3 of REPORT OF SYMPOSIUM IV; CHEMISTRY AND PHYSICS OF RADIATION DOSIMETRY [HELD AT THE] ARMY CHEMICAL CENTER 18, 19, and 20 SEPTEMBER 1950; PART I–UNCLASSIFIED PAPERS. Hugo Fricke. [nd] 44p. (NP-3237(paper 3))

Reactions have been found to take place between the solute and active particles produced by the action of x and γ radiation on a wide variety of both organic and inorganic substances in water. The basic physical principles of this mechanism are outlined and the reactions observed by various investigators are discussed in some detail.
86 references.

5110
Army Chemical Center, Md.
THEORY OF RADIATION CHEMISTRY, I. SOME CHEMICAL EFFECTS OF VARIATION OF IONIZATION DENSITY,

paper 4 of REPORT OF SYMPOSIUM IV; CHEMISTRY AND PHYSICS OF RADIATION DOSIMETRY [HELD AT THE] ARMY CHEMICAL CENTER 18, 19, and 20 SEPTEMBER 1950; PART I—UNCLASSIFIED PAPERS. John L. Magee. [nd] 17p. (NP-3237(paper 4))

The ionization density in a homogeneous medium exposed to steady irradiation is a function of space and time, the space-time ionization density pattern depending on both the ionization density of the particles used in the irradiation and also the number of particles incident per unit time and area. A simple model is presented which describes the life of a particle track in the steady-state condition and thus also gives a description of the variations in ionization density. The model has a satisfactory physical basis and has the particular advantage that mathematical treatment can be carried out rigorously. In this model account is taken of the background ionization density which is present when a track is formed; this background ionization density can be higher or lower than that of the track itself depending upon the diffusion rate of the ions and radicals formed, their recombination rate constants and the rate of irradiation. Yields in radiation chemistry depend upon whether the background is high or low; this situation is discussed in terms of the model with application to some problems of radiation chemistry. (auth)

5111

Army Chemical Center, Md.

EFFECT OF RADIATION ON COLLOIDAL AND HIGH POLYMERIC SUBSTANCES, paper 7 of REPORT OF SYMPOSIUM IV; CHEMISTRY AND PHYSICS OF RADIATION DOSIMETRY [HELD AT THE] ARMY CHEMICAL CENTER 18, 19, and 20 SEPTEMBER 1950; PART I—UNCLASSIFIED PAPERS. Malcolm Dole. [nd] 28p. (NP-3237(paper 7))

Polythene in the form of sheet film was subjected to the radiation of the Argonne heavy water pile for 45, 90, and 180 hr at the 300 kw operating level. Irradiations in the presence of both air and vacuum were carried out. Chemical analyses of film and gas liberated, infrared absorption studies, and tensile strength and stress-strain studies were made. Considerable unsaturation was produced in the vacuum irradiation along with some cross-linking of the polythene chains. Oxidation was the chief result of irradiation in the presence of air. Possible mechanisms for these results are proposed. A review and discussion of previous work are given. (auth) 17 references.

RARE EARTHS AND RARE EARTH COMPOUNDS

5112

Ames Lab.

THE VAPOR PRESSURE OF LANTHANUM AND PRASEODYMIUM. Adrian Hill Daane. Dec. 14, 1950. Decl. Aug. 1, 1951. 94p. (AECD-3209; ISC-121)

A technique for preparing rare-earth metals was developed in which their chlorides were reduced by Ca in Ta vessels; the resulting metal was cast in Ta molds to remove volatile impurities. An improved technique for measuring vapor pressures of materials of low volatility was devised; this consisted of modifying Knudsen's effusion method by placing a quartz fiber balance inside of the vacuum apparatus to measure weight losses from the effusion vessel. Methods of procedure and results are discussed at length. The vapor pressures of La and Pr were determined over the range 10^{-2} to 10^{-4} mm Hg using this technique. For La, the vapor-pressure equation is $\log P = -[(17753 \pm 308)/T] + (6.816 \pm 0.166)$; the heat of vaporization and extrapolated normal boiling point of La may be obtained from this equation, and are, respectively, -81.0 ± 1.4 kcal/mole and $4515° \pm 150°$K. For praseodymium, the vapor pressure equation is $\log P = -[(17188 \pm 243)/T] + 8.098 \pm 0.156$. The heat of vaporization and extrapolated normal boiling point are, respectively, -79.5 ± 1.1 kcal/mole and $3290° \pm 90°$K. (auth)

5113

Radiation Lab., Univ. of Calif.

NEUTRON DEFICIENT EUROPIUM AND GADOLINIUM ISOTOPES. R. W. Hoff, J. O. Rasmussen, and S. G. Thompson. May 11, 1951. 6p. (UCRL-1291)

Neutron-deficient isotopes of Eu and Gd were produced by proton, deuteron, and He-ion bombardments of Sm and Eu, using the 60- and 184-in. cyclotrons and the proton linear accelerator. The decay of Eu 147, 148, and 149 was observed after proton bombardments of enriched Sm isotopes. Eu^{145} was observed as recoil nuclei from the alpha decay of Tb^{149}. Eu^{146} was observed after a He-ion bombardment of $Sm_2^{149}O_3$; (α,pn) or $(\alpha,2n)$ reactions were considered the predominant mechanisms. Gd^{149} was observed as a product in a number of different bombardments. Natural europium oxide was bombarded with protons in a stacked-foil arrangement which produced a proton energy range from 32 to 8 Mev. The Gd^{149} was produced in largest yield with 28- to 32-Mev protons, and a (p,3n) reaction was assumed. The Eu and Gd activities are tabulated.

5114

Radiation Lab., Univ. of Calif.

CONCERNING THE FORMAL POTENTIAL OF THE Ce(III)-Ce(IV) COUPLE IN PERCHLORIC ACID SOLUTIONS. Z. Zimmerman Hugus, Jr. July 9, 1951. 6p. (UCRL-1379)

The explanation by Duke and Bremer (AECU-1193, NSA 5-3104) of the variation with $HClO_4$ concentration of the formal potential of the Ce(III)-Ce(IV) couple observed by Smith and Goetz (Ind. Eng. Chem. Anal. Ed. 10, 191(1938)) as an effect of Ce(IV) hydration is thought to be unnecessary. Observations of a cell containing Fe(II), Fe(III), Ce(III), Ce(IV), and $HClO_4$ show that the activity product is constant over a wide range of concentrations, indicating that the Fe(II)-Fe(III) couple undergoes a variation approximately equal to the Ce(III)-Ce(IV). Since there is no reason for believing the Fe couple to have anomalous hydration behavior, the variation in the Ce(III)-Ce(IV) must be due to a change in the liquid junction potential of the cell used by Smith and Goetz.

5115

Atomic Energy Research Establishment, Harwell, Berks. (England)

VAPOUR PRESSURES OF SOME RARE EARTH HALIDES. E. R. Harrison. Feb. 2, 1951. 7p. (AERE G/R-695)

Approximate vapor pressures, in the range 10^{-1} to 10^{-3} mm Hg, have been measured by the method of molecular effusion for $LaCl_3$, $CeCl_3$, $PrCl_3$, $NdCl_3$, $LaBr_3$, $CeBr_3$, $NdBr_3$, and $SmBr_3$. The method is discussed briefly, and the apparatus used is diagramed. Results are tabulated. Also, a method is described for dehydrating rare-earth chlorides, bromides, and iodides such that in their anhydrous form they are free from any basic salts and are 100% volatile in vacuo.

SEPARATION PROCEDURES

5116

Geological Survey

APPLICATION OF MESITYL OXIDE TO THE DETERMINATION OF THORIUM. Harry Levine and F. S. Grimaldi. Feb. 1950. Decl. July 3, 1951. 20p. (AECD-3186)

Thorium nitrate is quantitatively extracted by mesityl oxide from solutions saturated with Al nitrate even in the presence of relatively large amounts of phosphate. U is the only other element extracted quantitatively by a single ex-

traction. Zr is largely extracted, whereas Y and V are extracted to a small extent. Ce in both valence states is extracted only to a very slight degree, ceric Ce being reduced probably by the olefinic bond in the solvent. Mesityl oxide thus is useful not only for the concentration of U and Th but also for the separation of Th from the rare earths, the separation taking about 10 min per sample. A detailed procedure is outlined for analysis of Th ores such as monazite, black sands, thorianite, thorite, euxenite, and eschynite.

5117

Hanford Works

THE MECHANISM OF EXTRACTION OF URANIUM BY TRIBUTYL PHOSPHATE. Robert Lee Moore. [nd] Decl. June 11, 1951. 10p. (AECD-3196)

The extraction of U and HNO_3 into tributyl phosphate (TBP) from aqueous uranyl nitrate hydrate, HNO_3 solutions has been studied. The results indicate that the mechanism of U extraction is one of simple complex formation, the reaction being UO_2^{++} (aq.) + $2NO_3^-$ (aq.) + 2TBP (org.) = $[UO_2(NO_3)_2(TBP)_2]$ (org.). The equilibrium constant of this reaction is about 7.7 at 25°C. These results are compared to those for the extraction of Ce(IV) by TBP. The extraction of HNO_3 was found to involve the formation of a weak complex containing one molecule of HNO_3 and one molecule of TBP. The equilibrium constant is about 0.2. Nitric acid is displaced from the organic phase by U due to the more stable complex formed by the latter with TBP. (auth)

5118

[Hanford Works]

PREPARATION OF CARRIER-FREE RADIOZIRCONIUM FROM PILE-IRRADIATED URANIUM. W. E. Roake. [nd] Decl. June 11, 1951. 8p. (AECD-3201)

The unique radiocolloidal behavior of Zr and its daughter Nb may be used to separate, by simple adsorption, carrier-free Zr and Nb from fission products. Relative adsorption capacities and effect of temperature and pH on adsorption are tabulated. The following detailed method is given: Zr and Nb are removed from a 1.5M nitrate solution of pile-irradiated U by adsorption on Super Filtrol during 1-hr heating to 100°C. The Filtrol cake is filtered and washed clean of supernatant with 0.01M HNO_3 and leached with 10M HNO_3 for 30 min at 100°C. The resulting solution of carrier-free Zr is freed from daughter Nb by an extraction cycle with 0.01M thenoyl trifluoro acetone in benzene.

5119

[Hanford Works]

REMOVAL OF IODINE FROM AQUEOUS SOLUTIONS BY SPARGING. C. H. Holm. [nd] Decl. June 11, 1951. 20p. (AECD-3202)

After investigating the effects of spargant (N_2, O_2, or air), flow rate, temperature, acidity, and the presence of an active metal (U), the author concludes that I may be removed from nitric acid–uranyl nitrate solutions by air sparging when present initially as either iodide, iodine, or iodate, provided means for conversion of nonelemental I to the zero oxidation state are provided. In the case of iodide, oxidation by nitric acid appears to be adequate. At high concentrations of the acid, removal is impaired, possibly because of oxidation to iodate. A reducing agent such as an active metal is necessary to effect removal of iodate by sparging.

5120

Chicago Univ.

RADIOCHEMISTRY OF SEVERAL OF THE URANIUM FISSION PRODUCTS. (dissertation). N. E. Ballou. June 1947. 118p. (AECU-1449)

Details of wartime search for a satisfactory separation of Rh from Te and other fission products are given, and the relative effectiveness of the various methods tried is discussed. A step-by-step procedure for extraction by pyridine, the best method found, is outlined. Outlines for radiochemical analyses of Mo and the rare earths are given and discussed in detail. The final section of the dissertation presents details of the isolation and characterization of the fission products 10.0-hr Y (Y^{93}?), 14-day Pr^{143}, 4-yr La subgroup (Pm^{147}?), 1.8-hr Ce (Ce^{145}?), and 4.7-hr Pr (Pr^{145}?).

5121

Columbia Univ. and Sloan-Kettering Inst. for Cancer Research

STUDIES ON THE STRUCTURE OF NUCLEIC ACIDS; III. KINETICS OF THE ALKALINE HYDROLYSIS OF YEAST PENTOSE NUCLEIC ACID. Liebe F. Cavalieri. [nd] 13p. (AECU-1469)

The kinetics of the alkaline hydrolysis of yeast pentose nucleic acid have been investigated by means of a continuous stirred flow reactor. This technique allows the direct measurement of the rates of formation of the various nucleotides at different degrees of hydrolysis. Complex rate curves were obtained indicating that nucleic acid can yield nucleotides by a mechanism involving simultaneous reactions of both the direct and consecutive types. An adequate theoretical curve was constructed for cytidylic acid by treating the velocity constants as parameters. The reaction mechanism employed for the derivation of the equations was essentially: nucleic acid → nucleotides; and nucleic acid → nucleotides + intermediates → nucleotides. Assignment of the various constants to particular groups was not attempted. On the basis of the velocity constants, there appear to be at least two types of phosphate linkage present in pentose nucleic acid, one much more labile than the other. Further, the results could not be expressed quantitatively by assuming that the nucleic acid sample investigated consisted of one type of molecule. (auth)

5122

Iowa State Univ.

SEPARATION OF GASES BY DIFFUSION THROUGH PERMEABLE MEMBRANES; PROGRESS REPORT. Karl Kammermeyer. Oct. 31, 1950. 113p. (AECU-1492)

A selected bibliography is given of literature concerned with various methods for the separation of gases. Reprints have been made of articles from the German journal Z. Ver. deut. Ing. (Verfahrens technik), which were found in a literature search and were considered important in the study of the separation of gases by diffusion through permeable membranes. Tabulation has been made of the various gases and of the composition of the various plastic films which are to be used in the study of the separation of gases by membrane diffusion. Experimental accomplishments in the transmission of O_2, H_2, CO_2, and N_2 through porous glass membranes and in the separation of mixtures of H_2 and O_2 and of air by diffusion through plastic membranes (polyethylene) are presented.

5123

Knolls Atomic Power Lab.

THE DISTILLATION OF LITHIUM METAL. Leo F. Epstein and W. H. Howland. July 2, 1951. 6p. (AECU-1549)

A detailed explanation is given of the procedures and problems arising in the distillation of Li metal. The Li in a Ag crucible, heated by induction, is placed in a glass system and a chimney is welded over the crucible to prevent spattering. A distillation rate of about 1 g of Li/hr was achieved, and it has been found convenient to distill 1 to 2 g at a time in the system. The resulting Li on exposure to air at room temperature does not react and darken as rapidly as a freshly cut surface of commercial Li will, but retains a shiny and metallic luster for 10 hr or more.

5124
Knolls Atomic Power Lab.
BIBLIOGRAPHY ON DISTILLATION. S. J. Lawrence and Eloise Givens, comp. Aug. 15, 1951. 16p. (KAPL-588)

An annotated, selective bibliography on certain phases of distillation, extraction, and absorption covering approximately the period 1925 to 1950 is presented. 121 titles.

5125
North American Aviation, Inc.
THE REMOVAL OF SMALL AMOUNTS OF POTASSIUM FROM SODIUM. W. C. Ruebsamen. July 27, 1951. 9p. (NAA-SR-139)

A method for the removal of small amounts of K from Na metal by digestion with graphite at elevated temperatures is described. Residual K in the Na is about 0.003 wt. %. (auth)

5126
Oak Ridge National Lab.
NUCLEOSIDE-5'-PHOSPHATES FROM RIBONUCLEIC ACID. Waldo E. Cohn and Elliott Volkin. June 4, 1951. 9p. (ORNL-1007)

The exclusion of C_5 phosphoryl linkages from ribonucleic acid (RNA) structure rests principally on the failure to isolate 5′ nucleotides or the acid-stable ribose-5-phosphate from acid hydrolysates of RNA. The experiments described in the present paper indicate that intact 5′ nucleotides can be isolated from enzymatically-hydrolyzed calf liver RNA. Digestion of the calf liver RNA by ribonuclease and alkaline intestinal phosphatase in the presence of sodium arsenate was followed by isolation of the nucleotide products by an anion exchange procedure. Identification was made by comparing properties with synthetic 5′ nucleotides. Reasons are given for excluding enzymatic resynthesis of smaller fragments, rearrangements of mononucleotides, or the pre-existence of free 5′ compounds.

5127
Radiation Lab., Univ. of Calif.
CARRIER-FREE RADIOISOTOPES FROM CYCLOTRON TARGETS; XVII. PREPARATION AND ISOLATION OF Fe^{59} FROM COBALT. Jeanne D. Gile, Warren M. Garrison, and Joseph G. Hamilton. May 18, 1951. 3p. (UCRL-1315)

A discussion is given of the preparation, without the use of added carrier, of Fe^{59} by the reaction $Co^{59}(d,2p)Fe^{59}$. After the 2.6-hr Mn^{56} [from the reaction $Co^{59}(n,\alpha)\,Mn^{56}$] had decayed, the surface of the bombarded target was removed by dissolution in HCl, neutralized by the addition of water and NH_4OH, and drawn through filter paper. The carrier-free Fe^{59} was quantitatively retained on the filter as adsorbed radiocolloid. The filter was washed first with dilute NH_4OH until Co could not be detected in the filtrate and then washed with distilled water. More than 98% of the Fe^{59} remained on the filter paper. The activity was then removed with HCl which was evaporated to incipient dryness and diluted to 0.1N at which pH the Fe^{59} remained in true solution.

5128
Radiation Lab., Univ. of Calif.
A METHOD FOR CONTINUOUS EXTRACTION WITH A CHELATING AGENT. W. Wayne Meinke and Richard E. Anderson. July 1951. 11p. (UCRL-1397)

A continuous extractor for use with chelating agents has been developed. Specifically, gram amounts of Th as the nitrate salt have been extracted using a solution of thenoyltrifluoroacetone (TTA) in benzene. One gram of Th can be extracted in about 3 hr. The extractor is especially useful for work with very radioactive materials since shielding is simple and most operations are automatic. (auth)

5129
Radiation Lab., Univ. of Calif.
CARRIER-FREE RADIOISOTOPES FROM CYCLOTRON TARGETS; XIX. PREPARATION AND ISOLATION OF $Pt^{191,193}$ FROM OSMIUM. Jeanne D. Gile, Warren M. Garrison, and Joseph G. Hamilton. June 26, 1951. 3p. (UCRL-1418)

The report is reproduced here in its entirety.

Radioactive platinum produced by bombardment of osmium with 38-Mev alpha-particles has been isolated without addition of isotopic carrier. The following two radioisotopes of platinum are produced by (α,n), $(\alpha,2n)$, and $(\alpha,3n)$ reactions with alpha particles of this energy: 3-day Pt^{191} and 4.3-day Pt^{193}. The carrier-free radioplatinum was separated from the target element and from the possible radioisotopes of Ir (from α,pn reaction) and Re (from n,p reaction) by a solvent-extraction procedure based on the solubility of chloroplatinous acid in ethyl ether.

A 2-mm layer of c.p. osmium powder, supported on a grooved water-cooled aluminum target plate by a 0.25-mil tantalum foil, was bombarded for 40 μa-hr. at an average beam intensity of 7 μa, in the 60-in. cyclotron at Crocker Laboratory. The osmium was obtained from Johnson Mathey & Co. Pt was not detected by spectrographic analysis.

The bombarded osmium was dissolved in aqua regia, additional 16N HNO_3 was added, and the osmium was volatilized as the tetraoxide. After the osmium had been volatilized the HNO_3 was destroyed with excess of 12N HCl. The acid solution containing the active $Pt^{191,193}$ was diluted with distilled water to make the solution 3N in HCl, 1 ml of 10% $SnCl_2$ was added, and the chloroplatinous acid was extracted with ethyl ether which had previously been saturated with 3N HCl. Under these conditions more than 95% of the carrier-free radioplatinum is recovered in the organic phase. The ether layer was washed with 6N HCl and the activity was quantitatively retained in the organic layer. A 20-mg sample of NaCl was added to the ether phase and the mixture was evaporated to dryness on a steam bath. The carrier-free $Pt^{191,193}$ was redissolved quantitatively in 2 ml of distilled water at pH 6 to give an isotonic saline solution for biological experiments.

The radioplatinum was identified by half-life determinations, absorption measurements, and by chemical separation with carrier. The decay was followed for 40 days and showed the 3.0-day Pt^{191} and the 4.3-day Pt^{193} (Seaborg and Perlman, Revs. Modern Phys. 20, 585(1948)). Seven days after bombardment the activity showed predominantly the 4.3-day period. Aluminum and lead absorption measurements two days after bombardment showed the 0.5-Mev conversion electron and the 0.57-Mev gamma ray previously reported for Pt^{191} (Wilkinson, Phys. Rev. 73, 252(1948)). An aliquot of the solution was added to a solution containing carrier amounts of Os, Ir, Re, and Pt. The radioactivity was quantitatively recovered in the Pt fraction following chemical separation according to the method of Noyes and Brag ("A System of Quantitative Analysis for the Rare Elements," The MacMillan Company, New York, (1927)).

5130
Radiation Lab., Univ. of Calif.
CARRIER-FREE RADIOISOTOPES FROM CYCLOTRON TARGETS; XX. PREPARATION AND ISOLATION OF $Ru^{97,103}$ FROM MOLYBDENUM. Jeanne D. Gile, Warren M. Garrison, and Joseph G. Hamilton. July 12, 1951. 3p. (UCRL-1419)

The report is reproduced here in its entirety.

Alpha-particle bombardment of molybdenum produces the 2.8-day Ru^{97} and the 42-day Ru^{103} by the nuclear reactions, $Mo(\alpha,xn)Ru^{97}$, and $Mo^{100}(\alpha,n)Ru^{103}$ (Nuclear Data, Natl. Bur. Standards, Sept. 1, 1950). This paper reports a method of isolating this activity in the carrier-free state from the target element and from radioisotopes of Tc (from α,pxn reactions) which are produced concurrently by the 40-Mev

alpha particles from the 60-in. cyclotron at the Crocker Laboratory.

The target was a block of c.p. molybdenum metal, silver-soldered to a water-cooled copper target plate. It was bombarded with 40-Mev alpha particles for a total of 70 μa-hr. at an average beam intensity of 8 μa. The bombarded surface was removed by milling off ~0.5 g of Mo. The Mo chips were fused with 5 g of KOH and 0.5 g of KNO_3 in a nickel crucible at 500°C for 15 min. The fused mass was dissolved in a minimum amount of hot water and centrifuged to remove insoluble material. The strongly basic solution was transferred to an all-glass distilling flask according to the method of Scherrer (J. Research Natl. Bur. Standards, 21, 95(1938)), a stream of Cl_2 was bubbled through the solution, and the active ruthenium was distilled as the RuO_4 which was collected in a trap containing 12N HCl cooled with ice. Under these conditions the technetium isotopes remain in the distilling flask with the target material. The acid distillate containing the radio-ruthenium was evaporated to a small volume, made basic with NaOH, and redistilled into a trap containing 12N HCl. The second distillation was done to insure complete separation from the target material. The final HCl solution was evaporated to dryness on 20 mg of NaCl and the activity dissolved quantitatively with the addition of 2 ml of distilled water.

An aliquot of the preparation was added to a solution containing carrier amounts of Mo and Ru. The activity was quantitatively recovered in the Ru fraction following chemical separation. The radiation characteristics were obtained by aluminum and lead absorption measurements and showed the 0.2-Mev conversion electron and the 0.23-Mev γ ray previously reported for Ru^{97} (Eggen and Pool, Phys. Rev. 74, 57(1948)). The activity showed the 2.8-day period for nearly 15 half lives at which time it began to lengthen to a period of approximately 40 days, presumably due to Ru^{103}.

5131

Radiation Lab., Univ. of Calif.

CARRIER-FREE RADIOISOTOPES FROM CYCLOTRON TARGETS; XXI. PREPARATION AND ISOLATION OF $Tl^{200,201,202}$ FROM MERCURY. Jeanne D. Gile, Warren M. Garrison, and Joseph G. Hamilton. July 16, 1951. 3p. (UCRL-1420)

The report is reproduced here in its entirety.

This paper reports a procedure used in isolating radio-thallium in the carrier-free state from a mercury target which had been bombarded with 19-Mev deuterons in the 60-in. cyclotron at Crocker Laboratory. At this energy deuteron bombardment of mercury produces $Tl^{200,201,202}$ by the nuclear reactions $Hg^{199}(d,n)Tl^{200}$, $Hg^{200}(d,2n)Tl^{200}$, $Hg^{201}(d,n)Tl^{201}$, $Hg^{201}(d,2n)Tl^{201}$, $Hg^{201}(d,n)Tl^{202}$, and $Hg^{202}(d,2n)Tl^{202}$ (Seaborg and Perlman, Revs. Modern Phys. 20, 585(1948)). Other shorter-lived radioisotopes of thallium, notably the 7-hr Tl^{199}, were allowed to decay out prior to chemical separation.

The target chamber (Garrison, Haymond, and Hamilton, "Carrier-Free Radioisotopes from Cyclotron Targets; Preparation of F^{18} from Water," (unpublished data)) was made from a 100-ml pyrex flask and had a concave glass window approximately 4 cm in diameter and 0.15 mm in thickness with a total volume of 30 ml. The target flask was connected to a small reflux condenser and the flask was cooled by a stream of air during bombardment. The target was filled with liquid mercury (c.p., tripple distilled, thallium-free) and bombarded with 19-Mev deuterons for a total of 30 μa-hr. at an average beam intensity of 3.5 μa. After removal of the mercury from the target, it was found that the radio-thallium had deposited quantitatively on the walls of the glass flask. The mercury was discarded and the flask was washed twice with 16N HNO_3. The HNO_3 solution which contained the radio-thallium, and traces of mercury which had adhered to the glass surface, was evaporated to 2 ml, treated with excess 12N HCl to destroy the HNO_3, and diluted to ~3N HCl. This solution was then extracted with ethyl ether which had previously been equilibrated with 3N HCl. More than 95% of the carrier-free radio-thallium was removed from the aqueous phase. The ether fraction was washed with water to remove HCl and the activity was quantitatively retained in the organic phase. Fifty mg of NaCl was added to the ether solution and the mixture evaporated to dryness on a steam bath. The carrier-free $Tl^{200,201,202}$ redissolved quantitatively in 5 ml of distilled water and was adjusted to pH 6 to give an isotonic saline solution for biological investigation.

The radio-thallium was identified by half-life determinations, absorption measurements, and by a chemical separation procedure in which Au, Hg, and Tl were used as carriers. The decay curve was followed for 60 days and showed three periods: 27-hr Tl^{200}, 72-hr Tl^{201}, and 11.8-day Tl^{202}. Eleven days after bombardment the activity showed only the 11.8-day period. The aluminum absorption measurements four days after bombardment showed an end point of ~130 mg/cm^2 (Krishnan and Nohum, Proc. Cambridge Phil. Soc. 36, 490(1940)). Lead absorption measurements showed the 0.4-Mev gamma-ray assigned to Tl^{202} (Seaborg and Perlman, ibid.). Milligram amounts of Au, Hg, and Tl were added to an aliquot from the preparation and 98% of the activity was recovered in the Tl fraction, using a standard chemical procedure for isolation of the Tl (Noyes and Brag, "A System of Quantitative Analysis for the Rare Elements," The MacMillan Company, New York, (1927)).

5132

Radiation Lab., Univ. of Calif.

CARRIER-FREE RADIOISOTOPES FROM CYCLOTRON TARGETS; XXII. PREPARATION AND ISOLATION OF Pb^{203} FROM THALLIUM. Herman R. Haymond, Warren M. Garrison, and Joseph G. Hamilton. July 18, 1951. 3p. (UCRL-1421)

The report is reproduced here in its entirety.

The 52-hr Pb^{203}, produced by the reaction $Tl^{203}(d,2n)Pb^{203}$, has been isolated in the carrier-free state from a Tl target without the addition of stable lead carrier.

The target consisted of a 2-mm layer of Tl_2O_3 powder held on a grooved water-cooled copper plate by a 0.25-mil platinum foil and was bombarded with 19-Mev deuterons in the 60-in. cyclotron at the Crocker Laboratory. Lead was not detected by spectrographic analysis (less than 0.01%) in the Tl_2O_3 powder used for the target. The beam current was limited to 5μa to avoid volatilization of the target powder from overheating during bombardment.

After bombardment, the Tl_2O_3 powder was dissolved in 1N HNO_3. The solution was saturated with SO_2 gas to reduce the thallic ion to the thallous state, following which the solution was heated to expel the excess SO_2; 10 mg of ferric ion was added and the solution was made basic by the addition of NH_4OH. The precipitated $Fe(OH)_3$, which carried most of the Pb^{203}, was removed by centrifugation, washed twice with dilute NH_4OH and once with water, and dissolved in 1N HNO_3; 5 mg of inert thallic ion was added to the solution as holdback carrier, and the whole process was repeated. The process was repeated again without the addition of inert thallium. The third $Fe(OH)_3$ precipitate was dissolved in 6N HCl and the iron removed by four extractions with equal volumes of ethyl ether. After the addition of 25 mg of NaCl the solution was heated to dryness and then dissolved in water to give a solution of isotonic saline at pH 4 containing the carrier-free radio-lead, which was subsequently used for biological investigations.

Identification of the isolated activity was confirmed with an aliquot of the preparation by a chemical separation using milligram quantities of thallium, lead, and mercury. The decay curve, over a period of four half lives, and the absorption curves in aluminum and lead agreed with published data (Seaborg and Perlman, Revs. Modern Phys. 20, 585 (1948); Nuclear Data, Natl. Bur. Standards Circ. 499, (Sept. 1950); Templeton, Howland, and Perlman, Phys. Rev. 72, 766(1947)). The 68-min Pb^{204} which results from deuteron bombardment of thallium (Templeton, Howland, and Perlman, ibid.; Fajans and Voigt, Phys. Rev. 60, 619(1941)), was allowed to decay out prior to this separation.

5133

Radiation Lab., Univ. of Calif.

CARRIER-FREE RADIOISOTOPES FROM CYCLOTRON TARGETS; XXIII. PREPARATION AND ISOLATION OF $Rh^{100,101,102,105}$ FROM RUTHENIUM. Jeanne D. Gile, Warren M. Garrison, and Joseph G. Hamilton. July 16, 1951. 3p. (UCRL-1422)

The report is reproduced here in its entirety.

Radioactive rhodium, produced by the bombardment of ruthenium with 19-Mev deuterons, has been isolated without added isotopic carrier. Several radioisotopes of rhodium are produced by (d,n) and (d,2n) reactions with deuterons of this energy: 19-hr Rh^{100}, 4.3-day Rh^{101}, 210-day Rh^{102}, and 37-hr Rh^{105}, and short-lived Rh^{103} and Rh^{104} (Seaborg and Perlman, Revs. Modern Phys. 20, 585(1948)). The target was aged a few days to allow Rh^{103} and Rh^{104} to decay out prior to chemical separation. Small amounts of technetium are also produced concurrently by (n,p) reaction.

A 2-mm layer of c.p. ruthenium powder (spectrographic analysis of the powder showed less than 0.017% Rh), supported on a grooved water-cooled copper plate by a 0.25-mil platinum foil, was bombarded for 35 μa-hr at an average beam intensity of 5.5 μa. The ruthenium powder was fused with 10 g of Na_2O_2 in a nickel crucible at 300°C for 30 min. The small amount of Tc produced was lost in this step. The fused mass was dissolved in aqua regia with heating and the insoluble material centrifuged out. The solution was made basic with KOH, heated to approximately 100°C, and Cl_2 gas was bubbled through to volatilize the target ruthenium as RuO_4. The residue containing the radioactive rhodium and nickel which was dissolved from the crucible during fusion, was centrifuged out and found to carry 95% of the radiorhodium. The precipitate of nickel hydroxide was washed with water and dissolved in a minimum volume of dilute HNO_3. Five mg of Fe^{+3} were added to the acid solution and the $Fe(OH)_3$ precipitated with NH_4OH, which carried the active rhodium quantitatively and left the nickel in solution as $Ni(NH_3)_6^{++}$. The $Fe(OH)_3$ was reprecipitated twice, carrying the activity completely each time. The iron was dissolved in 6N HCl and extracted with ethyl ether. The aqueous phase containing HCl and the active rhodium was evaporated to dryness on 50 mg of NaCl and dissolved quantitatively in 5 ml of distilled water.

The decay curve was followed for 200 days and showed three periods: 37-hr Rh^{105}, 4.3-day Rh^{101}, and 210-day Rh^{102} (Sullivan, Sleight, and Gladrow, NNES, Div. IV, Vol. 9, "Radiochemical Studies: The Fission Products," paper 330, McGraw-Hill Book Company, Inc., New York (1951)). Twenty days after bombardment the decay curve showed the single period of 210-day Rh^{102}. Mass absorption measurements in aluminum and lead two days after bombardment showed the 0.78-Mev β-particles of Rh^{105}, and the 0.35-Mev and 0.33-Mev γ-rays of Rh^{101} and Rh^{105}, respectively. Milligram amounts of Ru and Rh were added to an aliquot of the preparation. The rhodium fraction was separated chemically and contained 98% of the activity.

5134

Atomic Energy Project, Univ. of Rochester

THE SEPARATION OF BERYLLIUM FROM BIOLOGICAL MATERIAL. T. Y. Toribara and P. S. Chen, Jr. May 24, 1951. 20p. (UR-170)

The quantities of Be which are of biological significance are extremely small, and the quantities used for study are limited by the sensitivities of the analytical methods. A separation scheme has been developed to serve both as a means of concentrating the Be and of removing interfering substances. All possible cations are removed by electrodeposition using a Hg cathode, and Be acetylacetonate is extracted into benzene at a suitable pH. The Be is then back-extracted into HCl. Al accompanies the Be but need not be separated if the morin method of analysis is employed. The radioisotope Be^7 was used for the studies and, by utilizing carrier-free isotopes, quantities (less than 10^{-10} g) undetectable by any chemical or spectrographic method were investigated. Quantities of this magnitude could be separated completely from urine, soft tissues, and even from bone if the extraction time were suitably increased. Ashing was found to be the most time-consuming step of the procedure. A thorough study of the wet and dry ashing methods showed that no losses of Be by volatilization ever occurred. The most rapid method of ashing for each biological specimen is given. Tedious and time-consuming steps were excluded without sacrificing completeness of separation. (auth)

5135

Atomic Energy Research Establishment, Harwell, Berks. (England)

LIQUID-LIQUID EXTRACTION; PART I. FLOODING RATES FOR PACKED COLUMNS. F. R. Dell and H. R. C. Pratt. Jan. 1951. 46p. (AERE-CE/R-592)

An improved method has been devised for the determination of flooding rates in packed liquid-extraction columns and flooding data for a 3- and a 6-in. ID column have been obtained using 10 different liquid-liquid systems and 9 different types of packing. A theoretical equation relating the flow rates of the phases at the flooding point has been derived, having different constants for Raschig rings, Lessing rings, and Berl saddles, and suitable values are given for design purposes. Experiments were also carried out to find the effect of modifications in the design of the column end pieces. It was found that no increase in throughput is gained by the use of the expanded separating section described by Blanding and Elgin (Trans. Am. Inst. Chem. Engrs. 38, 305 (1942)) and that there is no justification for increasing the diameter at the dispersed phase entry by more than 30 to 40%. It was confirmed that it is essential to introduce the dispersed phase directly into the packing and not beneath the packing support, as noted originally by Blanding and Elgin.

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Atomic Energy Research Establishment, Harwell, Berks. (England)

LIQUID-LIQUID EXTRACTION; PART II. HOLD-UP AND PRESSURE DROP IN PACKED COLUMNS. R. Gayler and H. R. C. Pratt. Jan. 1951. 41p. (AERE-CE/R-593)

Determinations of hold-up of solvent and of pressure drop in packed liquid extraction columns have been carried out using a column 3-in. ID by 10-ft high with five different solvent-water systems and six different packings. It is shown that the hold-up cannot be calculated directly from the pressure drop except in the case of the simple spray column. Logarithmic plots of hold-up against dispersed phase flow rate, with the continuous phase flow as parameter, were found to have slopes close to unity at low values of the

hold-up. When the latter reached about 15% a break occurred, the slope increasing abruptly. In some cases a second break occurred at high rates, there being a region of almost constant hold-up before the column flooded. Similar breaks occurred at the same flow-rates in the plots of pressure drop, and by analogy with gas-liquid columns it is proposed that the lower break should be referred to as the "loading point." The hold-up data were also used to calculate the mean velocities of the solvent droplets. The latter were found to increase initially with flow rate of the dispersed phase and then to fall rapidly. Based on these results, it is shown that two, or sometimes three regimes of flow occur in packed extraction columns and a qualitative explanation is proposed for the flow pattern in each regime. Below the loading point it is shown that the hold-up is related to the flow rates of the phases by the following simple expression: $x = V_d/(\bar{v}_0 - V_{c/y})$ where $\bar{v}_0$ is the mean droplet velocity at 0 continuous phase flow rate. By means of this expression, together with tabulated values of the hold-up and pressure drop at loading and of the slopes of the hold-up and pressure drop curves, the latter curves can be reconstructed without recourse to the original data. (auth)

5137

Atomic Energy Research Establishment, Harwell, Berks. (England)

LIQUID-LIQUID EXTRACTION; PART III. A STUDY OF DROPLET BEHAVIOR IN PACKED COLUMNS. J. B. Lewis, I. Jones, and H. R. C. Pratt. Jan. 1951. 38p. (AERE-CE/R-594)

The formation and breakdown of droplets in packed liquid extraction columns has been studied using a 2-in. ID column with a packed height of 3 ft. Photographs were taken of the solvent droplets entering and leaving the packing. Experiments were carried out with nine different liquid-liquid systems and six different packings and the dimensions of the droplets recorded. From the results a number of statistical mean diameters were computed, of which the most important was the mean volume-surface diameter. An analysis of the results shows that the mean diameter of the droplets leaving the column is independent of the size of those entering, provided the latter are above a minimum size below which growth is very slow. There appears to be a critical size of packing above which the mean droplet diameter is independent of the packing size and type. Under these conditions the mean droplet diameter is independent of the flow rate of the dispersed plase until the flooding rate is approached, but it increases slowly with the flow of the continuous phase. With packings below the critical size the mean droplet diameter is greater, although still independent of the dispersed phase flow rate. Finally, with the critical size itself the diameter at low flow rates of dispersed phase is the same as for the larger packings, but it increases rapidly with flow. An explanation of these phenomena is given, and it is shown that the mean droplet diameter in packings above the critical size at dispersed phase flow rates insufficiently high for coalescence to occur can be represented in terms of the physical properties of the system and the continuous phase flow rate. The size distribution of the droplets was also studied for a few typical runs and was found to be non-Gaussian. (auth)

5138

Atomic Energy Research Establishment Harwell, Berks. (England)

A NOTE ON THE CORRELATION OF FLOODING RATES FOR PACKED GAS-LIQUID COLUMNS. F. R. Dell and H. R. C. Pratt. Apr. 10, 1951. 12p. (AERE CE/R-696)

The following equation is proposed for the correlation of flooding rates for packed absorption and distillation columns:

$$1 + \left(\frac{\rho_g}{\rho_l}\right)^{0.36}\left(\frac{\mu_l}{\mu_g}\right)^{0.07}\left(\frac{L}{G}\right)^{0.64} = C_s\left[\left(\frac{V_g^2 a}{g\epsilon^3}\right)\left(\frac{\rho_g}{\rho_l}\right)\left(\frac{a\mu_g}{V_g\rho_g}\right)^{0.2}\right]^{-0.36}$$

This equation can be reduced to a form resembling the graphical correlation used by Sherwood et al. (Ind. Eng. Chem. 30, 765(1938)). A comparison with the available experimental data shows that agreement is good up to a critical value of the group on the right, beyond which the exponent changes sharply to −0.20. Derived values of the constant C_s are given for random and stacked Raschig rings, random Berl saddles, and random wire helices, and the applications and limitations of the equation are discussed.

5139

Atomic Energy Research Establishment, Harwell, Berks. (England)

THE CATION EXCHANGE SEPARATION OF ZIRCONIUM AND HAFNIUM. B. A. J. Lister and L. A. McDonald. Apr. 1951. 39p. (AERE C/R-703)

The separation of Zr and Hf by cation-exchange methods has been examined and a simple method developed depending on sulfuric acid elution whereby a complete separation of gram quantities of these elements from a natural mixture (~2%Hf) can be made in one experiment.

SORPTION PHENOMENA

5140

[Louisville Univ.]

ADSORPTION OF ALIPHATIC ACIDS ON A WEAK BASE ANION EXCHANGER. Sigfred Peterson and Robert W. Jeffers. [nd] 12p. (AECU-1415)

Equilibrium isotherms have been measured at 30.3°C for the reaction between Amberlite IR-4B and chloracetic, formic, acetic, propionic, butyric, and isobutyric acids. The Langmuir isotherm is obeyed up to 0.3M for the latter two acids, up to 0.7M for the others; the deviations at high concentrations which are greater for butyric and isobutyric are probably due to true adsorption. The anion in the resin is probably held by the cationic group.

5141

Notre Dame Univ.

THE REACTION OF METHYL RADICALS WITH HYDROGEN. R. D. Anderson, S. Davison, and M. Burton. [nd] 18p. (AECU-1433)

The reaction between methyl and molecular hydrogen follows the simple mechanism $CH_3 + H_2 - CH_4 + H$. Results of early experiments and calculations are summarized, but it is stated that interpretations of the older literature were confused by use of low activation energy and low steric factor for this reaction. More recent experiments are discussed, including an investigation by Anderson and H. S. Taylor of the photolysis of cadmium dimethyl in the presence of H_2 (to be published in J. Phys. & Colloid Chem.) and a study by Davison and Burton of the photolyses of acetone and of acetaldehyde in presence of D_2 and in presence of equimolar mixtures of H_2 and D_2 (to be published in J. Am. Chem. Soc.). In recent work, effects of reaction order, hot radicals, surface, and uncertainties regarding elementary reactions have been largely eliminated. The results lead to an activation energy value of $E_1 \simeq 13$ kcal and a steric factor $E_1 \simeq 10^{-2}$. The former figure is in agreement with recent best values on activation energy of the reverse reaction and pertinent bond dissociation energies.

SPECTROSCOPY

5142

Ames Lab.

SPECTROPHOTOMETRIC DETERMINATION OF SILICON

IN THE PRESENCE OF ZIRCONIUM, BERYLLIUM, ALUMINUM AND CALCIUM. Anton B. Carlson and Charles V. Banks. June 5, 1951. 23p. (AECU-1375)

The Mo-blue method, based on preliminary formation of molybdisilicic acid followed by reduction to a heteropoly blue complex, together with HF treatment of the samples, was chosen to fulfill the need for a rapid method for trace-Si analyses. A close relationship exists between pH, fluoride concentration, and rate of formation of molybdisilicic acid. The reduction step was found relatively free of interferences. The use of HF to ensure complete solution of the silica present is shown to be an invaluable adjunct to the method.

5143

Brookhaven National Lab.

ABSORPTION SPECTRA OF CHLOROPHYLLS IN SOLUTIONS AT LOW TEMPERATURES; EQUILIBRIA BETWEEN ISOMERS. Simon Freed and Kenneth M. Sancier. [nd] 14p. (AECU-1411)

The spectra of solutions of the chlorophylls a, b, and b′ were measured from the temperature of liquid nitrogen to room temperature. The solvents consisted of di-n-propyl ether and a 1:1 mixture of propane and propene for the lower temperatures and of the ether and hexane for the higher temperatures. New features have appeared in the spectra which make it evident that each of the chlorophylls is an equilibrium mixture of two isomers. The temperature at which equal concentrations of the isomers co-exist is about the same for chlorophyll a and chlorophyll b but that for chlorophyll b′ is about 50° higher. The resulting difference in the relative amounts of the isomers in chlorophylls b and b′ over a considerable range of temperature makes great differences in the appearance of the over-all spectra which are practically the same at room temperature. Some of the finer features of the spectra indicate that along with chlorophyll b on the chromatographic column is adsorbed another component, probably not yet isolated, which has an absorption spectrum similar to but distinguishable from that of chlorophyll b at the low temperatures.

SYNTHESIS

5144

Oregon Univ. Medical School

PREPARATION OF BIOSYNTHESIZED C^{14} LABELED CHOLESTEROL. J. T. Van Bruggen, T. T. Hutchens and H. S. West. [nd] 7p. (AECU-1393)

Details are given for the biosynthesis of C^{14}-labeled cholesterol and its purification via the dibromide derivative, use being made of the active sterol synthesis of the young rat.

5145

Los Alamos Scientific Lab.

MICRO SYNTHESES WITH TRACER ELEMENTS; XXI. THE SYNTHESIS OF THIAMIN LABELED WITH C^{14}. D. Lloyd Williams and Anthony R. Ronzio. [nd] 19p. (AECU-1394; LADC-989)

The compound 2-C^{14}-2-amino-4-methyl-5-(β-hydroxyethyl)-thiazole and its hydrochloride have been prepared, the chemical procedure being outlined. 2-C^{14}-4-methyl-5-(β-hydroxyethyl)-thiazole has been prepared in a high yield by the reduction of diazotized 2-C^{14}-2-amino-4-methyl-5-(β-hydroxyethyl)-thiazole hydrochloride. An exhaustive investigation of the reduction of the diazonium salt has been completed. It has been shown that 2-methyl-4-amino-5-bromomethyl pyrimidine dihydrobromide will react with boiling butanol to give an ether. 2-methyl-4-amino-5-butoxymethyl pyrimidine (and hydrobromide) has been prepared. Thiamin (vitamin B_1) hydrobromide has been prepared labeled with C_{14} at the 3-position in the thiazole moiety. (auth)

5146

Los Alamos Scientific Lab.

MICRO SYNTHESES WITH TRACER ELEMENTS; XXVII. THE SYNTHESIS OF C^{14} METHYL IODIDE. A. R. Ronzio. [nd] 9p. (AECU-1435; LADC-1000)

After reviewing the disadvantages of methods given in the literature for the preparation of $C^{14}H_3I$, the author describes a modification of the Zeisel reaction involving direct reaction of $C^{14}H_3OH$ with HI to give 95 to 100% yields. A vacuum system is not required.

5147

Oregon State Coll.

PREPARATION OF S^{35}-LABELED SULFUR DIOXIDE AND SULFURIC ACID. B. J. Masters and T. H. Norris. [nd] 4p. (AECU-1447)

A simple and convenient technique is described for the preparation of S^{35}-labeled sulfur dioxide and concentrated sulfuric acid, with neutron-irradiated KCl as starting material. The method depends on the occurrence of an exchange reaction between these two compounds and leads to high specific activities and good percentage yields. (auth)

5148

Carbide and Carbon Chemicals Co., K-25

PREPARATION AND PROPERTIES OF TELLURIUM TETRAFLUORIDE. J. H. Junkins and E. J. Barber. June 5, 1951. 20p. (K-768)

TeF_4 was prepared in a two-step process from elemental F_2 and Te. Direct combination of the elements at 200°C in the presence of excess F_2 produced the hexafluoride which was subsequently reduced to the tetrafluoride with additional metal at 180°C. TeF_4 melts at 129.6°C. Its vapor pressure from room temperature to 193.8°C may be described by the equations $\log_{10}P_{mm}$ (solid) = 9.0934 − 3174.3/T and $\log_{10}P_{mm}$ (liquid) = 5.6397 − 1786.4/T. Above 193.8° TeF_4 is unstable toward the hexafluoride. From these equations the following thermodynamic properties are calculated: ΔH_v = 8174 cal/mole; ΔS_v = 12.62 e.u.; ΔH_s = 14525 cal/mole; ΔH_f = 6351 cal/mole; ΔS_f = 15.77 e.u., where ΔH_v, ΔH_s and ΔH_f are heats of vaporization, sublimation, and fusion respectively. TeF_4 is consumed by metallic Cu at 185° forming copper telluride and cupric fluoride. It reacts less rapidly with Ag and Au and very slowly with Ni, but not with Pt. The crystals are isomorphous with ZrF_4 and UF_4. (auth)

5149

Pittsburgh Univ.

THE SYNTHESIS OF CERTAIN BETA-DIKETONES CONTAINING PERFLUOROMETHYL AND PERFLUORO-n-PROPYL GROUPS. Lloyd B. Barkley and Robert Levine. [nd] 7p. (NYO-683)

The following β-diketones have been synthesized in high yield by acylation of the corresponding methyl ketones with ethyl trifluoroacetate or ethyl perfluoro-n-butyrate in the presence of Na methoxide: 4,4,4-trifluoro-1-(5-iodo-2-thienyl)-1,3-butanedione; 4,4,4-trifluoro-1-(3-methyl-2-thienyl)-1,3-butanedione; 4,4,4-trifluoro-1-(5-methyl-2-thienyl)-1,3-butanedione;4,4,4-trifluoro-1-(2,5-dimethyl-3-thienyl)-1,3-butanedione; 4,4,4-trifluoro-1-(2,5-dimethyl-2-furyl)-1,3-butanedione; 4,4,4-trifluoro-1-(3-thianaphthenyl)-1,3-butanedione; 4,4,4-trifluoro-1-(2-thianaphthenyl)-1,3-butanedione; 4,4,4-trifluoro-1-(2-methylpropenyl)-1,3-butanedione; 1-(5-chloro-2-thienyl)-4,4,4-trifluoro-1,3-butanedione; 1-(5-bromo-2-thienyl)-4,4,4-trifluoro-1,3-butanedione; 1-(2-benzofuryl)-4,4,4-trifluoro-1,3-butanedione; 4,4,5,5,6,6,6-heptafluoro-1-(2-thienyl)-1,3-hexanedione; 4,4,5,5,6,6,6-heptafluoro-1-(2-furyl)-1,3-hexanedione; 4,4,5,5,6,6,6-heptafluoro-1-(3-methyl-2-

thienyl)-1,3-hexanedione; 4,4,5,5,6,6,6-heptafluoro-1-(5-methyl-2-thienyl)-1,3-hexanedione; 4,4,5,5,6,6,6-heptafluoro-1-(2,5-dimethyl-3-thienyl)-1,3-hexanedione; 4,4,5,5,6,6,6-heptafluoro-1-(2,5-dimethyl-2-furyl)-1,3-hexanedione; 4,4,5,5,6,6,6-heptafluoro-1-(3-thianaphthenyl)-1,3-hexanedione; 4,4,5,5,6,6,6-heptafluoro-1-(2-methylpropenyl)-1,3-hexanedione; 1-(5-chloro-2-thienyl)-4,4,5,5,6,6,6-heptafluoro-1,3-hexanedione; 1-(5-bromo-2-thienyl)-4,4,5,5,6,6,6-heptafluoro-1,3-hexanedione; and 1-(2-benzofuryl)-4,4,5,5,6,6,6-heptafluoro-1,3-hexanedione.

5150

Pittsburgh Univ.

NEW COMPOUNDS; SYNTHESIS OF NEW BETA-DIKETONES (Contribution No. 818). Robert Levine and James K. Sneed. Apr. 16, 1951. 3p. (NYO-938)

Nicotinoyltrifluoroacetone (4,4,4-trifluoro-1-(3-pyridyl)-1,3-butanedione and isonicotinoyltrifluoroacetone (4,4,4-trifluoro-1-(4-pyridyl)-1,3-butanedione) have been synthesized by the acylation of ethyl trifluoroacetate in the presence of Na methoxide with 3- and 4-acetylpyridine, respectively. Nicotinoyl-2-thienylacetone (1-(3-pyridyl)-3-(2-thienyl)-1,3-propanedione) and isonicotinoyl-2-thienylacetone (1-(4-pyridyl)-3-(2-thienyl)-1-3-propanedione) have been prepared by the reaction of 2-acetylthiophene with methyl nicotinate and Na amide and with methyl isonicotinate and Na methoxide, respectively.

5151

Pittsburgh Univ.

THE RELATIVE REACTIVITIES OF THE ISOMERIC METHYL PYRIDINECARBOXYLATES IN THE ACYLATION OF CERTAIN KETONES; THE SYNTHESIS OF BETA-DIKETONES CONTAINING PYRIDINE RINGS (Contribution No. 819). Robert Levine and James K. Sneed. Apr. 16, 1951. 9p. (NYO-939)

Using Na methoxide to effect the condensations, the relative reactivities of the three methyl pyridinecarboxylates and methyl benzoate in the Claisen acylation of acetone, acetophenone, and pinacolone have been found to be picolinate > isonicotinate > nicotinate and/or benzoate. An explanation for this order of reactivity is given, and certain comments on the factors influencing the Claisen acylation of methyl ketones are made. Details of the syntheses of methyl picolinate, methyl nicotinate, pivaloylnicotinoylmethane (4,4-dimethyl-1-(3-pyridyl)-1,3-pentanedione), and pivaloylbenzoylmethane (1-phenyl-4,4-dimethyl-1,3-pentanedione) are given.

5152

Radiation Lab., Univ. of Calif.

HYDROGENATION OF FATTY ACIDS TO ALCOHOLS. P. T. Adams, R. E. Selff, and B. M. Tolbert. May 17, 1951. 11p. (UCRL-1300)

A procedure for converting fatty acids to the corresponding alcohols by high-pressure hydrogenation of the mixed Cd-Ni salts of the acid in the presence of copper chromite is described. Reductions were made on the normal and branched chain C_1 to C_8 acids with yields of 70 to 95%. The preparation was applied to the small-scale synthesis of a number of C^{14}-labeled alcohols, and these were converted to the corresponding halides for use as synthetic intermediates. This reduction method was used to convert $C^{14}O_2$ to methanol-C^{14} and methyl-C^{14} iodide by going though the intermediate, formic acid. The procedure was reliable and capable of good yields on a small scale. (auth)

5153

Radiation Lab., Univ. of California

PREPARATION OF VALINE-1-C^{14}. R. E. Selff and B. M. Tolbert. May 17, 1951. 5p. (UCRL-1301)

Valine-1-C^{14} has been prepared on a 20 millimole scale by the Strecker reaction. The yield was 51% based on KCN used to begin the synthesis. (auth)

5154

Radiation Lab., Univ. of Calif.

SYNTHESES OF C^{14}-LABELED GUANINE, ADENINE, 8-AZAGUANINE. Edward L. Bennett. May 17, 1951. 14p. (UCRL-1302)

Methods are described for the syntheses of adenine-4,6-C^{14} and 8-azadenine-4,6-C^{14} in yields of 20%, and of guanine-4-C^{14} and 8-azaguanine-4-C^{14} in yields of 45 to 50%, from sodium cyanide. The procedures use known synthetic methods with modifications to produce satisfactory yields for isotopic syntheses. (auth)

5155

Radiation Lab., Univ. of Calif.

SMALL SCALE PREPARATION OF C^{14} LABELED SUCCINIC, MALIC, FUMARIC, AND TARTARIC ACIDS. E. C. Jorgensen, J. A. Bassham, M. Calvin, and B. M. Tolbert. June 12, 1951. 9p. (UCRL-1327)

Synthesis of succinic-2-C^{14} acid together with malic-β-C^{14} acid was accomplished by reaction of ethyl acetate-2-C^{14} with diethyl oxalate in the presence of Na methoxide, followed by hydrogenation over a PtO_2 catalyst. The malic acid, separated from succinic by ether-water extraction, was dehydated to fumaric-2-C^{14} acid, which was then oxidized by $KClO_3$ and osmic acid to dl-tartaric-α-C^{14} acid. An alternate procedure for the synthesis of succinic-1-C^{14} or -2-C^{14} acids, superior in yield, purity of product, and reliability, was the reaction of ethyl chloroacetate-1-C^{14} or -2-C^{14} with diethyl malonate + Na, followed by refluxing with NaOH.

5156

Radiation Lab., Univ. of Calif.

TRITIATED STEARIC ACID. Donald J. Rosenthal and David Kritchevsky. June 6, 1951. 4p. (UCRL-1331)

This report is reproduced here in its entirety.

In order to carry out experiments involving fat metabolism in experimental atherosclerosis it was desirable to obtain pure, labeled fatty acid or fat. Inasmuch as a fatty acid such as stearic acid could be used as such or easily converted to triglyceride, this acid was chosen for labeling. The availability of tritium-labeled water and the ease of incorporation of this radioactive material in good yield influenced us to use this method of labeling. The method used was that worked out for deuterium labeling of fatty acids (van Heyningen, Rittenberg, and Schoenheimer, J. Biol. Chem. 125, 495(1938)). By this method, it was possible to obtain 36% of the equilibrium amount of tritium incorporated into the stearic acid. The acid was recovered quantitatively in the impure state; recrystallization yielded 95% of starting quantity with specific activity of 10.8 μc/mg.

Experimental: One gram of platinum oxide and 2 cc of tritiated water were introduced into a glass tube and the catalyst was reduced in a stream of hydrogen. The hydrogen was flushed from the tube with nitrogen, and, after several sweepings, stearic acid (7.5 g), potassium hydroxide (100 mg), and additional tritiated water (9 cc, 47 mc/cc) were added. The tube was evacuated, sealed, and shaken at 135° for 200 hr. After the shaking period, the tube was opened, attached to a vacuum line and pumped free of liquid. In all 10.9 cc (99%) of the initial water charge was recovered. The dried residue was dissolved in ether-benzene, acidified, and filtered through celite to remove catalyst. Evaporation of solvent left 7.5 g of crude material. The crude stearic acid was recrystallized from ethanol-water. The specific activity of the pure acid was found to be 81.1 mc, corresponding to 10.8 μc/mg. The yield of pure acid was 7.1 g (95%).

Summary: Tritium-labeled stearic acid of high specific activity has been prepared in good yield.

5157
Research Inst., Montreal General Hospital
CONTRIBUTION FROM THE DIVISION OF ATOMIC CHEMISTRY. L. Martin and S. B. Baker. [nd] 3p. (NP-3177)

Synthesis of 3-methylcholanthrene with radiocarbon in the 6 position was carried out by the following method: Labeled cuprous cyanide was heated with 4-methyl-7-bromo indan. The resultant 4-methyl-7-cyano indan was reacted with a Grignard solution prepared from α-bromonaphthalene and HCl to give 4-methyl-7-(α-naphthoyl)-indan. Pyrolysis of this ketone gave a yield of 3-methylcholanthrene which was 9.4% of the theoretical yield.

5158
Research Inst., Montreal General Hospital
SYNTHESIS OF CARBOXYL-LABELLED D-BIOTIN. S. B. Baker, D. E. Douglas, and A. E. Seath. [nd] 3p. (NP-3178)

D-biotin, C^{14}-carboxyl labeled, has been prepared in 60% over-all yield and specific activity of 693 cpm/mg by refluxing an available intermediate, D-3,4(2′-ketoimidazolido)-2-(ω-bromobutyl)-thiophane, with ethanol and $NaC^{14}N$.

TRACER APPLICATIONS

5159
Brookhaven National Lab.
AN N^{15} TRACER STUDY OF ORGANIC AZIDE REACTIONS; I. THE CURTIUS REARRANGEMENT OF 3,5-DINITROBENZAZIDE-N^{15}. Aksel A. Bothner-By and Lewis Friedman. [nd] 6p. (AECU-1401)

Nitric acid containing 31.4 at. % excess N^{15} had been converted to KNO_2 which was used in the preparation of 3,5-dinitrobenzazide from 3,5-dinitrobenzhydrazide. Thermal decomposition of the axide gave N_2 containing all the excess heavy N isotope and dinitroaniline of normal isotopic composition. This confirms the currently accepted mechanism of rupture of the α-β N−N bond followed by the elimination of a molecule of N_2. (auth)

5160
Pennsylvania Univ. School of Medicine
THE RELATION OF α-METHYLBUTYRATE TO ISOLEUCINE METABOLISM; I. ACETOACETATE FORMATION. Minor J. Coon and Norman S. B. Abrahamsen. [nd] 21p. (AECU-1584)

The synthesis of 2-methylbutyric-1-C^{14}, 2-methylbutyric-3-C^{14}, and butyric-3-C^{14} acids is described. A study of the metabolic fate of these compounds in liver slices has led to the following conclusions: The carboxyl carbon of methyl butyrate makes no significant contribution to acetoacetate formation, but it is readily converted to CO_2. Carbons 3 and 4 of methyl butyrate furnish an acetate-like fragment which is capable of condensing to form acetoacetate. With respect to its distribution in acetoacetate, this fragment is distinctly different from the terminal fragment of straight-chain fatty acids. The 4-carbon chain of methyl butyrate does not form acetoacetate without prior splitting, nor does the substrate undergo reductive demethylation or any other reaction leading to butyrate as the direct precursor of acetoacetate. It is proposed that methyl butyrate undergoes β oxidation on the longer carbon chain and splits to produce "acetate" and a 3-carbon acid.

TRANSURANIC ELEMENTS AND COMPOUNDS

5161
Radiation Lab., Univ. of Calif.
PROPERTIES OF THE ISOTOPE Pu^{243}. S. G. Thompson, K. Street, Jr., A. Ghiorso, and F. L. Reynolds. Nov. 6, 1950. Decl. July 10, 1951. 3p. (AECD-3192; UCRL-956)

The existence of Pu^{243} has been confirmed by measurement of the amount of Am^{243} formed by the reaction $Pu^{242}(n,\gamma)Pu^{243} \xrightarrow{\beta^-} Am^{243}$ in extensively neutron-irradiated plutonium samples and by direct observation of Pu^{243} produced by neutron irradiation of Pu^{242} obtained in relatively large amounts from the reaction $Am^{241}(n,\gamma)Am^{242} \rightarrow Pu^{242}$. The cross section for the $Pu^{242}(n,\gamma)Pu^{243}$ reaction was calculated. Maximum β-particle energy of 0.39 Mev and γ-ray energies of 0.095 and 0.12 Mev were found, and the half life was observed to be 5.0 ± 0.2 hr.

5162
Argonne National Lab.
PROPERTIES OF PLUTONIUM-243. J. C. Sullivan, G. L. Pyle, M. H. Studier, P. R. Fields, and W. M. Manning. [nd] Decl. July 9, 1951. 3p. (AECD-3195; AML-WMM-649)

To build up an appreciable concentration of higher Pu isotopes, a sample of Pu^{239} was subjected to a prolonged neutron irradiation. After irradiation the Pu was isolated from fission products and other impurities by extraction with di-ethyl ether, and then samples of a nitrate solution of this Pu were evaporated to dryness and irradiated in the thimble of the Argonne heavy-water reactor from 2 to 24 hr. A new Pu activity with half life 5.0 ± 0.2 hr and a maximum β energy of ~0.5 Mev was detected and assigned to Pu^{243}. Reasons for the choice of mass 243 as the source of the activity are given, and absorption and decay data are plotted. The capture cross section of Pu^{242} for pile neutrons was estimated to be ~100 barns.

5163
Atomic Energy Research Establishment, Harwell, Berks. (England)
THE MAGNETIC SUSCEPTIBILITY AND ELECTRONIC STRUCTURE OF PLUTONIUM TRIFLUORIDE AND TRICHLORIDE. J. K. Dawson, C. J. Mandleberg, and D. Davies. Feb. 7, 1951. 8p. (AERE-C/R-672)

The magnetic susceptibilities of PuF_3 and $PuCl_3$ have been measured over the temperature range 90 to 600°K. There is a minimum between 500 and 550°K in the susceptibility-temperature curve of the trivalent Pu ion, and the close resemblance of this behavior to that of the trivalent Sm ion is taken as good qualitative evidence for a $5f^5$ electronic configuration for the Pu ion. The application of Van Vleck's method for calculating the theoretical susceptibility yields 58 as the most probable value of the spin-doublet screening constant although at the higher temperatures the experimental magnetic susceptibilities are lower than the theoretical ones. (auth)

URANIUM AND URANIUM COMPOUNDS

5164
Brookhaven National Lab.
THE LEAD-URANIUM SYSTEM. R. J. Teitel. Feb. 2, 1951. Decl. May 29, 1951. 20p. (AECD-3173)

The U-Pb system has been investigated by x-ray, thermal, and microscopic analyses. Two intermetallic compounds were found: UPb_3 and UPb. X-ray diffraction identified UPb_3 as having a simple cubic structure, four atoms per cell, and lattice dimension 4.791 A. No appreciable solid solubility was found in either Pb in U or U in Pb. Four reactions were found in the system which are described by the following equations (subscripts are atomic per cent U): An eutectic at 325°C, $L_{0.02} = Pb_0 + UPb$; an eutectic at 1210°C, $L_{27.5} = UPb_3 + UPb$; an eutectic at 1125°C, $L_{99.5} = UPb + U$; and a syntectic at 1280°C, $L_{38.5} + L_{98.5} = UPb$. The melting point of UPb_3 is still uncertain. It is probably between 1210 and 1250°C. The allotropic transformations in U are unaffected by 1% Pb. (auth)

5165
Carbide and Carbon Chemicals Div., UCC., K-25
DIELECTRIC CONSTANT OF URANIUM HEXAFLUORIDE VAPOR AT 9400 MC/SEC. D. W. Magnuson. Nov. 29, 1950. Decl. June 1, 1951. 12p. (AECD-3175; K-689)

The dielectric constant, ϵ, of UF_6 vapor has been measured at 9400 Mc/sec. The value of $(\epsilon-1)$ corrected to standard conditions is $(4209.8 \pm 3.4) \times 10^{-6}$. The molar polarization is 31.453 ± 0.025 cc. The UF_6 molecule has no detectable dipole moment. (auth)

5166
Argonne National Lab.
THE ACETATE COMPLEXES OF URANYL ION AND THE SOLUBILITY OF SODIUM URANYL ACETATE. (Based on CN-391, Part B, Section 2, p.3-4) R. E. Connick and A. C. Wahl. Jan. 14, 1946. Decl. July 2, 1951. 11p. (AECD-3189; ANL-HDY-637)

The solubility of sodium uranyl acetate was measured under a variety of conditions. From the variation of the solubility with sodium ion, acetate ion, and acetic acid concentrations it was shown that over nearly all the range of conditions investigated the U is present in solution in the form of an acetate complex having the formula $UO_2Ac_3^-$. Evidence was obtained at low acetate ion concentration of uranyl species containing less than three acetate ions per U. No uranyl complex containing more than three acetate groups was observed. This latter fact is explained if both oxygens of each acetate group are attached directly to the U, as under these conditions there is only room for three acetate groups around a uranyl ion. (auth)

5167
Oak Ridge National Lab., Y-12 Area
SPECTROPHOTOMETRIC INVESTIGATION OF THE URANYL FLUORIDE COMPLEXES. C. A. Blake, R. S. Lowrie, and K. B. Brown. May 24, 1951. 45p. (AECD-3212; Y-771)

The absorption spectra of $UO_2(NO_3)_2$–NaF solutions having F to U mole ratios ranging from 0 to 9 have been studied at pH levels of 0.5, 1.0, 2.0, 3.0, and 6.0. Evidence is presented for the existence of three uranyl fluoride complexes: UO_2F^+, UO_2F_2, and $UO_2F_4^{--}$. Approximate dissociation constants, calculated according to the equations $UO_2F^+ = UO_2^{++} + F^-$ and $UO_2F_4^{--} = UO_2^{++} + 4F^-$, are reported. 15 figures. (auth)

5168
Battelle Memorial Inst.
THE URANIUM–CARBON SYSTEM. M. W. Mallett, A. F. Gerds, and H. R. Nelson. Apr. 1, 1951. Decl. Aug. 29, 1951. 32p. (AECD-3226; BMI-63)

An investigation of the U-carbon system has been made and a constitutional diagram drawn on the basis of melting-point, x-ray, and metallographic data. Three carbides of U were detected and identified, UC, U_2C_3, and UC_2. No compounds were found having a C content higher than that of UC_2. UC and UC_2 are completely soluble in each other at elevated temperatures, forming a solid solution. The solid-solution phase cannot be retained on cooling to room temperature in alloys containing between about 5.0 to 9.0 wt. % C. A Widmanstätten type of precipitation takes place on cooling, leaving either UC precipitated in a UC_2 matrix or vice versa, depending on the C content of the alloy. In alloys containing above ~9.0 wt. % total C, UC can quite effectively be retained in solid solution by quenching from temperatures above ~1800°C. 17 photomicrographs. (auth)

5169
Brookhaven National Lab.
THE MAGNETIC SUSCEPTIBILITY OF URANIUM TETRACHLORIDE. R. Stoenner and N. Elliott. [nd] 4p. (AECU-1390)

The magnetic susceptibility of anhydrous UCl_4 has been measured by means of a Gouy balance and is tabulated and plotted over the temperature range 76 to 354°K. It was found that the Weiss-Curie law is followed in this range and that the molar susceptibility is given by the equation $\chi_{mol} = 1.22/(T + 39°)$. This leads to a magnetic moment of 3.14 Bohr magnetons. UCl_4, therefore, behaves magnetically like other tetravalent U salts which have been recently measured. Comments are made on the possible states of the U^{4+} ion.

ENGINEERING

HEAT TRANSFER AND FLUID FLOW

5170
Wichita Univ.
THE PERMEABILITY METHOD OF DETERMINING SURFACE AREAS OF FINELY DIVIDED MATERIALS. L. L. Lyon, Director. Mar. 15, 1951. 41p. (AECU-1409)

The theory and experimental techniques of the permeability method of determining surface areas of finely divided materials are developed. The theory of flow of gases through porous media has been studied, and equations describing the various types of flow are presented. The design and operation of permeability apparatus, tamping apparatus, and He displacement apparatus are discussed and diagramed. Powdered metals, powdered ores, carbon blacks, and various catalysts of surface area 0.08 to 100 m^2/g have been investigated, and results are tabulated and plotted. Two different factors have been discovered that, if present, can cause difficulty in the use of this method. If several small particles of a powder are agglomerated during the manufacture of the powder, this agglomeration may cause nonuniform packing to occur when the powder is used in the permeability apparatus. The second difficulty arises from adsorption of the permeability gas on a high-surface-area powder. Adsorption difficulties were not observed when He was used as the permeability gas.

5171
Iowa State Univ.
A STUDY OF THE PERMEABILITY OF PLASTIC MEMBRANES TO GASES. (thesis). David William Brubaker. 1951. 79p. (AECU-1493)

Results are given of an investigation of the rate of gas (N_2, O_2, H_2, and CO_2) permeation through a number of selected plastic membranes at different temperatures and, in particular, of the effect of varying amounts of plasticizer in the membrane upon the rate of gas permeation. 61 references

5172
Argonne National Lab.
ANALYSIS OF HEAT TRANSFER, BURNOUT, PRESSURE DROP AND DENSITY DATE FOR HIGH-PRESSURE WATER. W. H. Jens and P. A. Lottes. May 1, 1951. 69p. (ANL-4627)

Heat-transfer, pressure-drop, and water-density data during forced convection and local boiling heat transfer have been correlated from data obtained by UCLA, MIT, and Purdue. In forced convection, the data were correlated by means of the Colburn equation. Dissolved gas had very little effect on the heat-transfer coefficient. The temperature of the heat-transfer surface during boiling was independent of the water temperature and velocity and was dependent only on the heat flux and the water pressure. Dissolved gas had very little effect on the temperature of the heat-transfer surface. The density data obtained at high pressures using the x-ray measurements indicated that pressure has a very large effect on the density of water during local boiling. 36 graphs, 10 tables.

5173

California Univ.

FINAL REPORT ON STUDIES IN BOILING HEAT TRANSFER. V. N. Tramontini, M. L. Greenfield, G. C. Wong, R. P. Lipkis, H. I. Leon, R. K. Breeze, G. S. Arbuthnot, W. L. Martin, P. Wiener, A. Auerbach, R. E. George, J. R. Hall, F. E. Romie, B. R. Mead, A. G. Guibert, G. H. Zizicas, B. Bussell, H. Buchberg, R. Bromberg, and L. M. K. Boelter. Mar. 1951. 516p. (COO-24)

In the investigation of which this is the final report, the desire to use water as a heat-transfer medium in the process of converting energy released in a nuclear reactor to useful work led to obtaining data at fluid pressures up to 2500 psia, temperatures up to 650°F, local velocities up to 55 fps and heat flux densities up to 3.8×10^6 Btu/hr/ft^2. Presented in this lengthy and detailed report are the forced-convection heat transfer and pressure-drop studies at elevated pressures with and without surface boiling; the analysis, design, and development of an x-ray densitometer; fundamental studies including boiling heat transfer from various metals to water in an annular flow system, an investigation of liquid superheat, shadowgraphic studies of boiling on a submerged horizontal cylinder, and remarks on the mechanism of heat transfer to boiling liquids; and the design and development of a burnout control system. 171 figures. (Chapter III, section A on Boiling Heat Transfer from Various Metals to Water in an Annular Flow System was abstracted in Nuclear Science Abstracts as NSA 5-1548.)

5174

Knolls Atomic Power Lab.

TRANSIENT THERMAL STRESSES IN CIRCULAR DISKS. G. Horvay. Aug. 3, 1951. 97p. (KAPL-512)

This report first evaluates the stresses and distortions which are produced when a steady temperature distribution is maintained in a circular disk. The simple results for radial and tangential edge displacements are particularly noteworthy. The more general problem of determining the temperature transient and stress transient in a solid disk due to an applied edge temperature is then treated. The various stresses are derived for the case of thermal shock (t = very small). For the steady state (t = very large), stressless strain results.

5175

Knolls Atomic Power Lab.

HEAT TRANSFER MEASUREMENTS AT SODIUM–STAINLESS STEEL INTERFACE. J. W. Moyer and W. A. Riemen. June 1, 1951. 19p. (KAPL-567)

Experiments have been performed to measure the heat-transfer coefficient at the interface between liquid Na and type-347 stainless steel as a function of the temperature of the Na from 100 to 500°C. Clean surfaces (degreased and sometimes polished) were outgassed thoroughly under high vacuum conditions and the contact made with triply distilled Na. In two of the three experimental arrangements it was possible to make visual observations of the progress of wetting. Diagrams of the apparatus are shown. The only evidence of thermal impedance of the interface came with preliminary measurements in the first apparatus. In view of the lack of substantiation of the earlier observed effect, one is forced to conclude that under the conditions of these experiments wetting plays little, if any, part in the heat transfer at the sodium–stainless-steel interface.

5176

Columbia Univ.

HEAT TRANSFER BY NATURAL CONVECTION FROM HORIZONTAL CYLINDER TO LIQUID METALS; JANUARY 1, 1951, TO MARCH 31, 1951. Seymour C. Hyman and Charles F. Bonilla. Mar. 31, 1951. 5p. (NYO-563)

Molten lead was heated by natural convection from a horizontal cylinder. Correlation of the heat-transfer coefficient thus obtained, shown on graphs as Nusselt number vs. functions of the Prandtl and Grashoff numbers, agrees with previous metals studied. As before, in NYO-562, the agreement with the (Gr x Pr) correlation was poor, and with the Eckert correlation good. (auth)

5177

Commissariat à l'Énergie Atomique

NOTE ON MEASUREMENT OF THERMAL CONDUCTIVITY OF SINTERED URANIUM DIOXIDE. (In French) M. Englander. June 1951. 13p. (CEA-79)

Thermal conductivity of sintered UO_2 was determined by measuring the quantity of heat having passed in unit time through a plate of given dimensions when a certain temperature difference was being maintained at the faces of the plate. Specimens, about 10 and 40 mm thick and about 65 mm in diam., were heated electrically, the temperature of both faces being measured by means of iron-constantan thermocouples. The accuracy of the device in its present shape is not high, the relative error being ~15%. The thermal conductivity of sintered UO_2 in the temperature range 20 to 250° was found to be about 9×10^{-3} cgs units.

MATERIALS TESTING

5178

Knolls Atomic Power Lab.

GRAVITATIONAL STRESSES IN A DISK SUPPORTED AT THE ENDS OF THE HORIZONTAL DIAMETER. G. Horvay and H. Poritsky. Apr. 10, 1951. 70p. (KAPL-518)

A circular disk, held vertically by supports at the ends of the horizontal diameter, incurs stresses and deformations produced by its weight. The stresses and deformations are most pronounced near the junction of the disk and supports. Their evaluation is carried out for concentrated supports and for distributed supports. The solution finds application in determining the load-carrying capacity of tube sheets.

MINERALOGY, METALLURGY, AND CERAMICS

5179
Bureau of Mines
OIL-SHALE OPERATIONS IN NEW SOUTH WALES, AUSTRALIA. A. J. Kraemer and H. M. Thorne. July 1951. 52p. (BM-RI-4796)

A detailed and comprehensive description is given of equipment and operations of National Oil Proprietary, Ltd., at Glen Davis, New South Wales. The divisions of the plant from mine to market are discussed and illustrated by photographs and extensive diagrams; analyses of products are presented in tabular form; the history of the industry in N. S. Wales and living conditions in the village are also considered.

5180
General Electric Research Lab.
FUNDAMENTAL RESEARCH IN PHYSICAL METALLURGY; TENTH QUARTERLY REPORT. (Progress Report No. 27) J. H. Hollomon and D. Turnbull. July 5, 1951. 12p. (SO-2014)

The self-diffusion coefficient of Ag over the free surface of a single crystal has been measured at 350°C and found to be 1.6×10^{-5} cm²/sec. Co activity coefficients have been measured as a function of temperature in the Co-Pt system for several compositions. Measurements have also been made as a function of temperature of the activity of Fe in an Fe-Ni alloy of 0.75 atom fraction of Fe. It has been determined that the heat capacity of high-purity Acheson-type graphite is proportional to T^2 at very low temperature in agreement with the Gurney theory of heat capacity.

CERAMICS AND REFRACTORIES

5181
Battelle Memorial Inst.
ALUMINUM TITANATE AS A CERAMIC MATERIAL. W. J. Koch and C. G. Harman. Nov. 20, 1950. Decl. July 30, 1951. 32p. (AECD-3213; BMI-T-44)

Experiments have been conducted to determine the properties of Al titanate, a compound containing equimolecular proportions of alumina (Al_2O_3) and titania (TiO_2). It has unusually low thermal-expansion coefficients, but bodies made of the equimolar compound are very weak mechanically. The addition of an excess of Al_2O_3 increases the strength but also increases thermal expansion, while excess TiO_2 decreases both and increases fired shrinkage and porosity. In order to obtain bodies of good strength and homogeneity, the mixture of alumina and titania was first converted to $Al_2O_3.TiO_2$ by firing to a temperature of 1820°C, milled to an average particle size of $\sim 6\ \mu$, and then fabricated and fired to 1650°C. The porcelain contamination acquired during grinding improved the thermal stability of the specimens and also improved their mechanical properties. The coefficient of linear thermal expansion of relatively pure aluminum titanate samples over the range from $\sim +300$ to -180°C increases uniformly as temperature decreases. The crystals appear to be arranged randomly within the specimens. Preliminary observations indicate an orthorhombic crystal form. Substitution of chromic oxide for Al oxide in Al titanate, ~1%, markedly increases both the strength of the body and the linear thermal expansion. Analysis of Al titanate by electrical methods indicated no transition points in the electrical resistivity between room temperature and 1370°C. 16 graphs and photomicrographs.

5182
Argonne National Lab.
THE REACTION OF BERYLLIUM OXIDE WITH WATER VAPOR. Leonard Grossweiner and R. L. Seifert. July 30, 1951. 22p. (AECU-1573; UAC-421)

At high temperatures the volatility of BeO has been shown to be greatly increased by the presence of steam. In this respect BeO is similar to the oxides of B, Si, Mo, and W. The information obtained in the present experiment is compared with results of previous studies, and it is concluded that the precision of the available data does not permit an unequivocal determination of the mechanism whereby the volatility is increased. The data that have been obtained indicate that the volatilization is caused by the reaction $BeO\ (s) + H_2O\ (g) - Be(OH)_2\ (g)$, which is similar to the mechanism that has been proposed for the volatility of HBO_2 in steam. (auth)

5183
Mass. Inst. of Tech.
THE MEASUREMENT OF THERMAL CONDUCTIVITY OF REFRACTORY MATERIALS. F. H. Norton and W. D. Kingery. July 1, 1951. 32p. (NYO-599)

Thermal conductivity values of beryllia, mullite, and zircon up to 1300°C and of Al_2O_3 and MgO from room temperature to 500°C are reported. Errors involved in the ellipsoidal method of thermal conductivity determination are reviewed. Additional equipment for use of a comparative method has been designed. A theoretical treatment of the effect of porosity on thermal conductivity has been completed and is presented in detail. For the high-temperature range, use of W-IR thermocouples was found not feasible in the ellipsoidal method. Preliminary work on techniques for the forming of mullite, zircon, thoria, spinel, nitride, and carbide specimens is described.

5184
Massachusetts Inst. of Tech.
TENTH INFORMAL MONTHLY REPORT ON DEVELOPMENT OF METAL-CERAMIC COMPOSITIONS SUITABLE FOR SERVICE AT ELEVATED TEMPERATURES. W. D. Kingery, G. Economos, M. Humenik, Jr., and M. Berg. May 1950. 6p. (NEPA-1449)

In the study of metal-ceramic wettability, contact angles have been determined for Bi on Mo silicate, Ni on graphite, and Be on alumina. Approximate calculated values of the surface tension of various pure metals are tabulated. Firing of Ti, Si, Zr, Mo, Nb, and Ni to 1825°C in contact with alumina and stabilized zirconia has been completed with preliminary observations. Certain free energies of oxidation-reduction for the metals and oxides have been calculated from thermodynamic data. Results of the preliminary study of sintering of NaCl and NaCl-metal combinations using powder compacts in place of pressed disks are briefly discussed.

5185
Armour Research Foundation
DEVELOPMENT OF CERAMIC MATERIALS OF HIGH ELECTRICAL CONDUCTIVITY (Quarterly Report No. 2). Apr. 15, 1951. 14p. (NP-3240)

Yellow, metallic crystals of sodium-tungsten bronze are formed through the reduction of sodium tungstate with a combination of tungstic oxide and tungsten under an inert atmosphere at temperatures between 850 and 900°C. A lattice parameter of 3.8517 A was obtained from x-ray diffrac-

tion patterns of the cubic crystals. This value checks with known data for Na-W bronze. Similar reactions with Zr and Zirconyl tungstate at higher temperatures (1200°C) result in the formation of blue materials. The blue products approach the compositions expected for Zr and zirconyl-tungsten bronze which are represented by the formulas $Zr(WO_3)_4$ and $ZrO(WO_3)_2$, respectively. X-ray diffraction analysis indicates that they are compounds and not fused mixtures of the starting materials. (auth)

GEOLOGY

5186

Wisconsin Univ.

THE THERMOLUMINESCENCE OF ROCKS. Farrington Daniels and Donald F. Saunders. [nd] 1p. (AECU-1439)

The report is reproduced here in its entirety.

Many rocks when heated emit light due to the release of electrons which have been driven into traps by radiation from traces of radioactivity over geological periods of time. Most fluorites, limestones, and potassium feldspars exhibit this phenomenon.

Of 1500 samples of common rocks examined, more than 75% showed visible thermoluminescence.

Automatically recorded curves were obtained giving the intensity of light as a function of time while the rock samples were heated at a rate of about 50°C/per min. The intensity peaks in the curves are characteristic of the minerals present in the rock, the radioactivity content, the impurities in the minerals, and the geological history of the rock.

Thermoluminescence has been produced in minerals and pure crystals by exposure to radioactive cobalt produced in the Nuclear Reactor at Argonne National Laboratory. The gamma-induced thermoluminescence curves have been compared with the natural thermoluminescence curves in attempting to interpret the geological history of the samples.

The pattern of thermoluminescence as photographed can be correlated with the patterns of radioactivity as obtained by exposure to nuclear track photographic plates and, hence, shows the distribution of radioactive minerals in granites.

The shape of the gamma-induced thermoluminescence curves from limestones can be used as a tool for acertaining whether samples from different localities are from the same rock stratum.

The study of mineral crystals which have been adjacent to radioactive minerals in nature makes possible the determination of radiation damage produced by very long exposure to radioactivity.

5187

Geological Survey

A PHOTOMETRIC METHOD FOR THE ESTIMATION OF THE OIL YIELD OF OIL SHALE. (Trace Elements Investigations Report No. 152) Frank Cuttitta. May 1951. 30p. (TEI-152)

A method is presented for the distillation and photometric estimation of the oil yield of oil-bearing shales. The oil shale is distilled in a closed test tube and the oil extracted with toluene. The optical density of the toluene extract is used in the estimation of oil content and is converted to percentage of oil by reference to a standard curve. This curve is obtained by relating the oil yields determined by the Fischer assay method to the optical density of the toluene extract of the oil evolved by the new procedure. The new method gives results similar to those obtained by the Fischer assay method in a much shorter time. The effects are shown of different experimental conditions upon the oil yield by the proposed method: effect of heating time on yield, effect of heating temperature on yield, effect of solvent on color, stability of color in toluene, color similarity of oils, and the relation of optical density to the Fischer yield. The applicability of the new method to oil-bearing shale and phosphatic shale has been tested. (auth)

METALS AND METALLURGY

5188

Los Alamos Scientific Lab.

A SPECTROPHOTOMETRIC STUDY OF THE OXIDATION OF TANTALUM. J. T. Waber, G. E. Sturdy, E. M. Wise, and C. R. Tipton, Jr. Mar. 23, 1951. 57p. (AECU-1355; LADC-740)

The air oxidation of Ta has been studied by newly developed spectrophotometric and microgravimetric methods in the temperature range 220 to 350°C. The resistance of Ta to oxidation and to thermal cycling of the oxide-covered metal is excellent up to 320°C. Highly adherent scales were formed despite frequent heating and cooling. On the basis of other data not specifically included in this report, Ta follows a logarithmetic rate equation up to approximately 320°C. Above this temperature the rate law may be either parabolic or logarithmic, but an unambiguous choice cannot be made. A comparison of the results obtained by the two methods reveals good agreement. An estimate of the ratio of the true to the apparent surface area is 9.92 ± 0.07. The energy of activation for the initial parabolic rates of weight change was found to be 27.2 kcal/g mole which is in excellent agreement with the value of Gulbransen and Andrews. The logarithmic growth laws similarly gave straight lines on an Arrhenius plot. The energy of activation from the microbalance data was 12.57 kcal/g mole, and that from the spectrophotometer was 12 kcal. A high degree of reproducibility for heterogeneous reaction was achieved in this work. The triplicate determinations of surface area ratio were obtained with a probable error of 0.8%, and quadruplicate runs of the parabolic reaction rate constant gave a probable error of 3%. (auth)

5189

Knolls Atomic Power Lab.

THE YIELDING BEHAVIOR OF IRON SINGLE CRYSTALS. A. N. Holden. [nd] 4p. (AECU-1545)

Experiments were performed to study the behavior of single crystals of Fe to which small amounts of C and N_2 had been added. The experiments are not described, but results are stated and interpreted according to the concept of interaction of dislocations by collision. The following test results were obtained: (1) No yield point was found with completely annealed Fe crystals containing C under conditions of very accurate alignment during testing. (2) Very small amounts of plastic strain introduced intentionally into a carburized crystal followed by 100°C annealing for as short a period as 1 hr caused the crystal to exhibit a yield point on testing. (3) There is a size effect in the yield point elongation for strain-aged crystals; the larger of two identically oriented crystals will have the more pronounced yield point and the greater yield-point elongation (4) If a carburized single crystal is strained by light rolling, aged, and tested in tension, it shows no yield point. If strained in tension, aged, and retested in tension it exhibits a marked yield point.

5190

Knolls Atomic Power Lab.

THE INERT ARC WELDING OF THIN-WALLED TUBING. R. S. Zeno and H. L. C. Leslie. [nd] 21p. (AECU-1546)

The inert-arc welding of the following materials was investigated: type 347 stainless steel, A nickel, L nickel, SAE 1020 steel, ductile titanium, molybdenum, and Fernico. Particular emphasis was given to the joining of very thin

tubing. A total of 800 samples in 6 different joint designs were welded with a special machine built around a Hardinge lathe. The welding variables investigated were type of current, type of gas, gas flow, type of electrode, arc length, arc current (½ to 150 amp), arc voltage, air eddy currents, spindle speed (¼ to 2500 rpm), cleanliness of joint, joint fit, joint design, cleanliness of electrode, and method of starting arc. It is concluded that all the materials investigated are weldable by the inert-arc process, and specific suggestions are made to assure strong, leak-tight joints. Proper joint "fit-up" is one of the most important factors and wherever possible a press fit is recommended. The use of Zr oxide-coated or thoriated W electrodes resulted in a more stable arc. Argon was preferred to He when welding light sections of type 347 stainless steel. A radio-frequency pilot spark starting unit was preferred to the use of either a carbon pencil or touching the electrode to the work.

5191

Battelle Memorial Inst.

METALLOGRAPHIC IDENTIFICATION OF NONMETALLIC INCLUSIONS IN ZIRCONIUM. H. A. Saller and R. F. Dickerson. July 1, 1951. 25p. (BMI-74)

Preliminary investigations indicate that there are certain typical modes of occurrence for the carbides, oxides, hydrides, and nitrides of Zr. Carbides occur as broken stringers or as spheroids which appear isotropic under polarized light. The carbide etches to light gray with $NH_4F \cdot HF$ and modified aqua regia. The inclusion believed to be the oxide occurs within the grain and along grain boundaries; it appears as discrete particles. Although no inclusion has been identified as, or even associated with, the nitride, there is some reason to believe that nitrogen-rich areas in iodide-Zr can be identified. These appear as "bands" which stain slightly when the polished metal is etched with $NH_4 \cdot HF$. The "spiny" rough-edged inclusion which is frequently observed in iodide-Zr, is believed to be a hydride. This inclusion is found as continuous stringers, which polish in slight relief and appear isotropic when examined by polarized light. 37 photomicrographs.

5192

Battelle Memorial Inst.

THERMAL CONDUCTIVITY OF SILVER-CADMIUM ALLOYS FROM 100°C TO 400°C. H. W. Deem and H. R. Nelson. July 26, 1951. 11p. (BMI-77)

Using the steady-heat-flow method, the thermal conductivities of a series of Ag-Cd alloys were measured over the range 100 to 400°C. Nominal compositions of the alloys varied from 5.4 to 35.7 wt. % Cd. Mean thermal conductivities ranged from 0.61 cal/cm²/cm °C/sec for 5.4 wt. % Cd to 0.33 cal/cm²/cm °C/sec for 36.7 wt. % Cd. (auth)

5193

Dow Chemical Co.

ROOM AND ELEVATED TEMPERATURE PROPERTIES OF POWDER EXTRUDED MAGNESIUM ALLOYS CONTAINING ALUMINUM, BERYLLIUM, AND ZIRCONIUM; FINAL REPORT; MAY 1, 1950–APRIL 30, 1951. [nd] 58p. (COO-48)

Final report is made of property tests of alloys listed in the title and of Mg-pure Ce alloys. The experimental procedures have been described in previous progress reports and are not discussed. Mg alloys containing up to 0.5 to 1.0% pure Ce offer the most promise for elevated-temperature applications where neutron capture cross section is also an important limiting factor. Although power-extruded Mg-Al-Zr alloys exhibit exceptionally high strengths at room temperature, their elevated-temperature properties, particularly creep resistance, are very low. Mg-Zr-Ca alloys are definitely superior to Mg-Zr-Al alloys both in strength and creep resistance at moderately elevated temperatures; however, these alloys cannot compete with Mg-Ce alloys in creep resistance. 15 tables, 7 graphs, and several microstructure photographs are included.

5194

Metals Research Lab., Carnegie Inst. of Tech.

PROGRESS REPORT FOR APRIL, MAY, JUNE, 1951. R. Smoluchowski, L. Couling, S. Hayes, R. Flannagan, C. W. Haynes, B. Sawyer and R. W. Turner. [nd] 4p. (NYO-522)

Brief discussions are presented of (1) an investigation of the grain-boundary diffusion in 3% Si-Fe and in brass-Cu couples, and (2) determination of the effect of a magnet field on the recrystallization textures in Fe-Co samples.

5195

Metals Research Lab., Carnegie Inst. of Tech.

ANNUAL REPORT FOR THE PERIOD JULY 1, 1950–JUNE 31, 1951. R. Smoluchowski, M. R. Achter, S. Hayes, L. Couling, R. Flannagan, C. W. Haynes, A. Opinsky, B. Sawyer, and R. W. Turner. [nd] 5p. (NYO-523)

Brief discussions are presented of (1) the results of a study of the influence of grain orientation on intergranular diffusion of Ag in Cu, (2) an apparatus for measuring small-angle x-ray scattering, and (3) a study of the influence of temperature of recrystallization on the texture of Fe-Co alloys.

5196

Massachusetts Inst. of Tech.

SOLID SOLUTIONS AND GRAIN BOUNDARIES; TECHNICAL PROGRESS REPORT NO. 6, SCOPE II. B. L. Averbach, L. Seigle, M. Cohen, E. S. Machlin, H. C. Gatos, and E. Underwood. Jan. 1, 1951. 8p. (NYO-578)

The following studies have been made of energy changes involved in solid solution formation and of the nature of grain boundaries in solid solutions. As part of an effort to determine the thermodynamic properties of solid Ni-Au alloys, measurements of the emf of galvanic cells using molten salt electrolytes have been made with an electrode containing 57 at. % Au. Results of experimental variations with several KCl-$LiCl$-$NiCl_2$ electrolytes are tabulated. The values are not in serious disagreement, and the scatter in partial molal values is not as great as that obtained with calorimetric determinations of heats of solution. An investigation by direct x-ray methods of the nature and magnitude of local order in solid solutions of the Au-Ni system is reported briefly. The presence of short-range order of the Cu-Au type was indicated, and it is stated that experiments are in progress to obtain numerical values of the local-order coefficients. General statements are made about a current investigation of the mechanism and kinetics of diffusion in the Au-Ni system. The interdiffusion coefficient $\tilde{D}$ will be determined as a function of composition and temperature by the Matano analysis. Activity coefficients of Zn in the Ag-Zn system and in ternary alloys of Ag, Zn, and Au are tabulated over the temperature range 525 to 660°C. Very brief statements are made of proposed grain-boundary studies with a microbeam x-ray camera and a bubble raft.

5197

Sintercast Corp. of America

PROGRESS REPORT FOR FEBRUARY 1, 1951, TO MAY 31, 1951, AND FINAL REPORT FOR MAY 1, 1950, TO MAY 31, 1951. Claus G. Goetzel and Richard B. Wagner. June 1, 1951. 15p. (NYO-690)

Data obtained during this period on production and determination of physical and chemical properties of cemented Zr carbide bodies with metallic binders are reported, and an evaluation of all results obtained during this investigation is presented. It is concluded that ZrC produced by cold pressing and sintering will form cemented bodies with binders such as Fe, Ni, 18-8 stainless steel, and 80-20 Ni-Cr.

Forming of similar bodies by hot pressing will require special apparatus and techniques to cope with the high temperature of pressing necessary for satisfactory consolidation. In the case of 10% Ni binder material, fully dense bodies having high modulus of transverse rupture values, in the vicinity of 100,000 psi, can be obtained. In all compositions tested, the cemented bodies had insufficient stability in withstanding exposure to still air at 1000°C for any period of time; all specimens broke down after 30 to 60 min of exposure.

5198

American Smelting and Refining Co.

FINAL REPORT; PROBLEM NO. 539. J. L. Everhart and E. L. Van Nuis. June 15, 1951. 28p. (NYO-763)

Unstressed static and dynamic tests have been run on a number of standard stainless steels, proprietary steels, Ti and several Ti alloys, V, and Zr to determine their resistance to attack by various liquid low-melting Bi-base alloys of In, Pb, Sn, and Tl. The effect of temperature on the viscosities of the Bi-base alloys has been investigated.

5199

Columbia Univ.

THE STUDY OF DIFFUSIONLESS PHASE CHANGES IN SOLID METALS AND ALLOYS; PROGRESS REPORT FOR MARCH 1 TO MAY 31, 1951. T. A. Read, L. C. Chang, M. W. Burkart, D. S. Lieberman, S. Zirinsky, J. Intrater, and R. Bakish. June 15, 1951. 7p. (NYO-932)

Preliminary experiments show that quenching of Au-Cd (49 at. % Cd) from above the ordering temperature of this alloy depresses the temperature of transformation to the tetragonal phase. Similar experiments on a specimen (47.5 at. % Cd) show that quenching suppresses its transformation to the orthorhombic phase and causes it to transform at a much lower temperature to a new phase. The quenching treatments also raised the electrical resistivity of the high-temperature cubic phase by as much as 10%. If the sample is maintained at a high temperature the increased electrical resistivity decreases to the characteristic value of an annealed sample. X-ray back-reflection Laue techniques show that a specimen consisting of differently oriented domains of the orthorhombic phase becomes a single crystal when compressed. Also a distorted surface of the orthorhombic alloy becomes flat by compression and returns to the distorted form upon release of the compression. Growth of single crystals of Fe-Ni (28.5% Ni) having a length of 3 to 8 times the diameter is described. Martensite flakes going across the crystals were formed by slow cooling of samples.

5200

School of Mineral Sciences, Stanford Univ.

INVESTIGATION OF MATERIALS FOR USE IN A HEAT TRANSFER SYSTEM CONTAINING MOLTEN LEAD ALLOYS; REPORT NO. XI; FEBRUARY 1, 1951, TO APRIL 30, 1951. (Progress Report No. 4) May 7, 1951. 15p. (ORO-34)

Results of stress-rupture tests of Nb in molten Pb at 1500°F are shown graphically. The extensions of Mo, Ta, and Nb during the second stage of creep at 1500°F have been measured. During stress-rupture test of Nb in Bi at 1500°F the Nb broke in a brittle manner even though none of the samples was the point of fracture near the center of the gage section. Photographs are shown of longitudinal sections of the gage length area of reduced diameter of the Nb samples tested in Pb and Bi. Microexamination of a stressed Nb sample showed the onset of corrosion at the sample surface, and also the formation of crystals of an unknown phase at the Nb-Bi interface. Results of experiments on the wetting of steels and other materials by liquid Pb and Be are presented.

5201

Institute of Engineering Research, Univ. of Calif.

INVESTIGATION OF CONVECTIVE HEAT TRANSFER IN SYSTEMS IN WHICH LIQUID LEAD-BISMUTH ALLOY IS USED AS THE MEDIUM; QUARTERLY PROGRESS REPORT DECEMBER 1, 1950 TO FEBRUARY 28, 1951. H. A. Johnson. Mar. 13, 1951. 5p. (ORO-37)

Brief statements are made concerning the status of various phases of an investigation of convective heat transfer in systems in which liquid Pb-Bi alloy is used as the transfer medium. Essentially no technical data are given.

5202

Stanford Univ., School of Mineral Sciences

INVESTIGATION OF MATERIALS FOR USE IN HEAT TRANSFER SYSTEM CONTAINING MOLTEN LEAD ALLOYS; PROGRESS REPORT NO. 2; AUGUST 1, 1950, TO OCTOBER 31, 1950. O. Cutler Shepard and Ralph Parkman. Oct. 31, 1950. 9p. (ORO-38)

The solubility of Fe in Pb has been determined for the temperature range 900 to 1850°F. A discontinuity in the solubility curve occurs at about 1660°F and is related to the α-γ transformation of Fe. Nonstressed corrosion tests in Pb have shown that Ti and Zr are severely attacked at 1500°F. Alteration previously reported (ORO-20, NSA 5-817) for Ta was found to be due to a slightly contaminated atmosphere. Under a sufficiently high vacuum Ta does not show attack. Nb showed no visible attack after 100 hr at 1500°F. Mo, Ta, and type-446 stainless steel showed no visible attack after 50 hr at 1750°F. Nonstressed tests of Mo, Ta, and type-446 stainless steel have been made in liquid Bi at 1800°F for 160 hr. No surface attack of the Mo could be detected. The other samples have not yet been studied. Ta and Mo appear to be unattacked in stress-rupture tests in Pb at 1500°F. Specimens under 20,000 psi have run 784 hr and are still unbroken. Type-446 stainless-steel specimen failed in 50 hr with a stress of only 2500 psi.

5203

Sylvania Electric Products, Inc.

SELF-DIFFUSION OF METALS AND ASSOCIATED PHENOMENA (V). PROGRESS REPORT; OCTOBER 1, 1950 - APRIL 1, 1951. B. H. Alexander, R. W. Balluffi, M. H. Dawson, C. A. Dube, H. P. Kling, and F. D. Rosi. July 12, 1951. 24p. (SEP-67)

A study by a variety of methods on the development of porosity during diffusion in binary systems has shown that porosity develops in all systems that have been investigated (Cu-Zn, Au-Ag, Ag-Sn, Cu-Ni). The relative diffusivities of Cu and Zn in α-brass have been measured, and it was found that $D_{Zn}/D_{Cu} \cong 6.5$. Dimensional changes normal to the diffusion direction were measured in the Ag-Au system; these changes are approximately 10% as large as those that occur parallel to the diffusion direction. The effect of orientation differences on the sintering of single crystals was studied and it was found that the sintering rate increases with the difference in orientation. Brief statements of progress but substantially no data are given for numerous other problems including the following: sintering of Cu wires and sintering of bimetal wire compacts; influence of grain boundaries on rate of evaporation of metals; diffusion of Ag in Ag-Sn alloys; secondary recrystallization rates in Cu, Al, and W; plastic flow in single crystals of Ag; creep in pure Ag.

5204

Atomic Energy Research Establishment, Harwell, Berks. (England)

ANELASTIC MEASUREMENTS OF DIFFUSION COEFFICIENTS IN F.C.C. SUBSTITUTIONAL SOLID SOLUTIONS. A. D. Le Claire. Mar. 30, 1951. 20p. (AERE-M/R-684)

It is shown how, in face-centered-cubic substitutional solid solutions of metals, measurements upon that form of anelasticity which is associated with the preferential reorientation of pairs of solute atoms in the presence of a tensile stress may be used to obtain the diffusion coefficient of the solute atoms. The method is closely analogous to the one employed recently by Zener and by Wert (Phys. Rev. 79, 601(1950)) to measure diffusion coefficients in interstitial solid solutions. The theory is applied to some previously reported anelastic measurements on (70/30) α-brass by Zener (Phys. Rev. 71, 34(1947)) and by Kê (Phys. Rev. 74, 16(1948)) to give the diffusion coefficient of zinc in the brass. The results show good agreement with directly measured and suitably corrected diffusion coefficients when these are extrapolated to the lower temperatures at which the anelastic measurements were made. There follows a discussion of the advantages and disadvantages of this method of measuring diffusion coefficients and of some possible further developments of the theory. (auth)

5205

Atomic Energy Research Establishment, Harwell, Berks. (England)

THE EXAMINATION OF METALS UNDER POLARISED LIGHT; II. ANALYSIS OF THE INTENSITY OF POLARISED LIGHT REFLECTED FROM METALS. B. W. Mott and H. R. Haines. May 18, 1951. 25p. (AERE M/R-698)

Expressions are derived for the relationship between the analyzed light reflected from a uniaxial absorbing crystal either under crossed polarizing units or with the analyzer slightly rotated from the crossed position. Four intensity maxima per complete rotation of the specimen are obtained when the polarizers are crossed but under certain circumstances, as the analyzer is rotated from the crossed position, the number of maxima may be reduced to two. These relationships are illustrated by experimental curves on electrolytically polished specimens of Sn and U. In the case of anodized Al, four maxima were still obtained after rotation of the analyzer. Curves on electrolytically polished Bi under crossed polarizers, using various objective lenses, show the effect of internal strain and of rotation of a strained objective in its mount. The results obtained with a strained objective not correctly positioned are similar to those produced by rotating the analyzer from the crossed position. (auth)

5206

NEPA Div.

SUMMARY REPORT ON THE ELECTRICAL PROPERTIES OF ARMCO IRON AND BERYLLIUM. F. K. Lampson. May, 4, 1951. 9p. (NEPA-1860)

The electrical resistivity of Armco iron and Be has been determined over a wide range of temperatures. The Be investigation was conducted in both purified He and in vacuo, while Fe was checked solely in a He atmosphere. The resistivity of Fe is reported up to 2450° F, which is an extension of approximately 300° F over any values found in the literature. The ferrite – austenite transformation is evident over the range of temperatures from 1670 to 1700° F, which is in close agreement to literature values. The resistivity of Be metal (Brush grade QM-V) is reported from room temperature to 2000° F. The resistivity-temperature relation is linear to 1400° F; thereafter, the resistivity increases rapidly with a subsequent increase in temperature. No phase change occurs in the Be throughout the temperature range of this investigation. (auth)

5207

Northwest Electrodevelopment Lab., Bureau of Mines, Albany, Oreg.

ZIRCONIUM PROCESS DEVELOPMENT; CONSOLIDATED REPORT NO. 1; 15 JUNE–15 NOVEMBER, 1950. W. W. Stephens. [nd] 32p. (NP-3126)

The Kroll process, essentially a multistep batch process, has been studied with a view toward consolidation. Double reduction runs have been made by carrying out a normal reduction in a new type furnace arrangement, blowing out the by-product MgCl, adding a second charge of Mg metal, and carrying out a second reduction right on top of the Zr formed in the first. Considerable time is saved in that all equipment remains at operating temperature during the change-over between reductions. In the development of a semicontinuous process, preliminary tests indicate the possibility of concentrating a Zr-Mg mud which is formed in reduction. This mud may be amenable to settling, rake classification, or filtering.

5208

Bureau of Mines

THE EXPLOSIBILITY OF TITANIUM, ZIRCONIUM, THORIUM, URANIUM, AND THEIR HYDRIDES. (Bureau of Mines Report No. 3202) Irving Hartmann. June 20, 1951. 29p. (NYO-1562)

A study has been made of the explosive characteristics of 9 metal and metal-hydride powders of average particle size 3 to 18 μ. Dust clouds of powders in air constitute severe potential explosion hazards. Layers of UH_3 and ThH_2 ignited spontaneously at room temperature within a few minutes after exposure in air. Layers of the other powders ignited at 100 to 510°C. When heated in CO_2 the dust layers ignited at 340 to 710° C, and in N_2 all except two powders (one Zr and ZrH_2) ignited at 210 to 790° C. U, UH_3, and finely divided Zr ignited at room temperature immediately upon dispersion into air. Clouds of the other powders ignited at 260 to 440° C. In CO_2, dust clouds of U, UH_3, fine Zr, and Th ignited at 560 to 740° C, but in N_2 none of the clouds ignited on contact with a hot surface at temperatures ranging up to 850° C, the highest tried. Neither dust layers nor dust clouds ignited in an atmosphere of pure He or A up to 850° C, but layers of all the powders ignited at 850° C (only temperature tried) in a 50-50% mixture of air and He. Dust clouds of several powders could be ignited by high-voltage electric sparks in an atmosphere of CO_2, but none ignited in N_2, He, or A. Layers of all samples could be ignited by weak electrical condenser discharge sparks having energies ranging from 4 μj to 1.5 mj. To effect ignitions of dust clouds in air, sparks of 3 to 60 mj energy were required. The lower explosive limits of dust clouds in air were determined to be 45 to 120 mg/liter (0.045 to 0.120 oz/ft^3). Explosions of dust clouds in air within the range of 0.200 to 4.000 oz/ft^3 were studied in a laboratory test bomb. The pressures developed in these explosions ranged up to 127 psi, the average rates of pressure rise up to 3700 psi/sec, and the maximum rates of pressure rise to over 10,000 psi/sec. (auth)

5209

CAPACITY AND DIELECTRIC LOSSES OF AN OXIDE LAYER DEPOSITED BY ANODIC OXIDATION ON ALUMINUM. W. Ch. van Geel and J. W. A. Scholte. Philips Research Repts. 6, 54-74(1951) Feb. (In French)

A model of the structure of the oxide layer on Al is given, based on measurements of the capacity and dielectric losses of this layer. It is found that the dielectric losses decrease with increasing thickness of the oxide layer. The capacity as a function of the forming voltage is measured by means of an a-c bridge and also by the ballistic method. The equivalent circuit for the capacity of the oxide layer is found to be a series of condensers with resistances in parallel. The values of these resistances increase steadily from low to very high values. In consequence of their

measurements the authors consider the layer to be built up in the following way. At the boundary Al-Al oxide there exists a layer containing an excess of Al atoms. These atoms produce a good conductivity of electronic character. In the direction of the electrolyte the concentration of the excess of atoms decreases. First comes an intermediate layer with higher resistances, and next a layer of very poor conductivity. An applied electric field seems to displace the atoms in excess and to change the mutual ratio of thicknesses of the different layers. The well-conducting layer is the cause of the dielectric losses. (auth)

5210

CRUSHING OF ALUMINUM TUBES UNDER HYDROSTATIC AND LOCALIZED PRESSURE. Marshall Holt. J. Applied Mech 18, 110-11(1951) Mar. (Discussion)

In a discussion of an article by E. Creutz (J. Applied Mech 72, 324-6(1950) Sept.)) it is pointed out that the author overlooked the significance of the modulus of elasticity and that stresses above the elastic stress range may be in error. It is also cautioned that the equation deduced by Creutz is applicable only to material having the same mechanical properties as that used by him.

5211

THEORY OF HOLLOW SINKING OF THIN-WALLED TUBES. S. Y. Chung. Metallurgia 43, 215-18(1951) May.

Plug drawing is virtually a combination of hollow-sinking and wall-ironing operations so that stress and strain analysis for hollow sinking will hold good for plug drawing up to the point where ironing starts. Using a modified criterion of plastic yielding, the author discusses the theoretical aspects of hollow sinking and compares his theoretical stresses with previously published experimental results on highly prestrained phosphorus-deoxidized Cu and soft brass, and his predicted strains with recent research data on aluminum and brass. (auth)

MINERALS AND MINERALOGY

5212

Chicago Univ.

THE DISTRIBUTION OF TRACE QUANTITIES OF URANIUM IN NATURE. (dissertation). George R. Tilton. June 1951. 54p. (AECD-3182; ANL-MGI-34)

The technique of isotopic dilution has been used in the determination of microquantities of uranium in 7 granitic minerals (perthite, quartz, plagioclase, magnetite, sphene, zircon, and apatite) and in 3 stony meteorites and Canyon Diablo troilite. Isotopic analysis of as little as 5 to 10 μg of U was possible through the use of surface ionization in the mass spectrometer. As utilized in this study, the method was capable of determining 0.0005 μg of U with an accuracy of $\pm\sim 50\%$. Recently an electron multiplier was installed on the mass spectrometer which improved the sensitivity by a factor of 100. The technique of isotopic dilution, materials used, computations, chemical procedures, and evaluation of contamination are discussed in detail. Further evidence was obtained for the belief that the U^{235}/U^{238} ratio is constant throughout nature. Uranium concentrations of the various rocks are tabulated. The method applied to granitic minerals promises greater accuracy and wider applicability to measurement of time intervals in nature than does any other technique available at present, but the uranium results on meteoritic matter indicate in general that the application of the lead-uranium age determination method to meteorites is difficult if not impossible.

5213

Oak Ridge National Lab., Y-12 Area

STUDIES OF RECOVERY PROCESSES FOR WESTERN URANIUM BEARING ORES; IX. PRECIPITATION OF YELLOW CAKE AND OF LOW LEVEL VANADIUM. Emily L. Leyshon and C. F. Coleman. Nov. 9, 1951. 34p. (AECD-3223)

Studies made during the period April to October 1949 on the precipitation of "yellow cake," a sodium uranyl vanadate, from carbonate leach liquors are summarized. Optimum conditions are given for the precipitation, with suggestions for process control. Also included are briefer studies of several methods of precipitating V from the resulting "purified liquor," including hydrolytic precipitation after reduction, phosphate precipitation after reduction, precipitation of ferrous or ferric vanadate, and precipitation of "red cake" (a sodium polyvanadate) together with the yellow cake.

5214

Wisconsin Univ.

THE THERMOLUMINESCENCE OF CRYSTALS; FINAL REPORT. Farrington Daniels and Donald F. Saunders. [nd] 261p. (AECU-1583)

After reviewing the history of research on thermoluminescence at the University of Wisconsin and outlining earlier researches, the report discusses in detail and presents extensive experimental data on the thermoluminescence and related properties of the alkali halides; application of this phenomenon to radiation dosimeters; thermoluminescence, radioactivity, and radiation-induced coloration in rocks and minerals; characteristics of the thermoluminescence of limestone and its use in subsurface stratigraphy and determination of geologic age and effects of igneous extrusion; and characteristics of the thermoluminescence of granites. Numerous glow curves of rocks, minerals, and crystals are presented. 79 figures.

5215

Bureau of Mines

SYNTHETIC LIQUID FUELS; ANNUAL REPORT OF THE SECRETARY OF THE INTERIOR FOR 1950; PART II. OIL FROM OIL SHALE. James Boyd, Director. Feb. 1951. 180p. (BM-RI-4771)

Detailed information is presented on activities of the oil-shale experimental mine and demonstration plant at Rifle, Colo., and related research and development work of the petroleum and oil shale experiment station, Laramie, Wyo. New and more efficient equipment and modifications in methods and procedures to reduce the cost of mining and processing oil shale, projection of data and experience to large-scale commercial mining operations, and oil-shale resources are discussed. 75 figures.

5216

Geological Survey

CARNOTITE DEPOSITS IN THE CARRIZO MOUNTAINS AREA, NAVAJO INDIAN RESERVATION, APACHE COUNTY, ARIZONA, AND SAN JUAN COUNTY, NEW MEXICO. W. L. Stokes. May 1951. 6p. (GS-C-111)

The carnotite deposits are in the Salt Wash sandstone member of the Morrison formation. The ore deposits consist of sandstone impregnated with carnotite and a vanadium-bearing mica. The ore contains from 0.1 to about 0.5% U_3O_8 and 1.0 to 5.0% V_2O_5, and much of the ore contains more lime as cementing material than does typical ore from Colorado and Utah. Most of the ore bodies are roughly tabular masses which are also irregular in plan, but some are elongate, pod-like masses, less common and less well-developed than those in Colorado and Utah. In general the deposits tend to form clusters in ill-defined areas. The deposits are believed to have formed from ground-water solutions shortly after the accumulation of the enclosing sands, and localization of the deposits does not appear to have been influenced by regional deformation, or igneous activity. Prospecting should be restricted to the Salt Wash sandstone member of the Morrison formation which contains all the known carnotite deposits. As these deposits tend to be grouped in clusters, prospecting

along and behind the exposures of closely spaced deposits will probably be most fruitful. Surface prospecting may yield new discoveries north and west of the Carrizo Mountains, in the area south of Red Rock Trading Post, and in the Chuska Mountains to the south. 1 map.

5217
New Mexico School of Mines
TABLES OF FLUORESCENT AND RADIOACTIVE MINERALS. (Circular 15) Robert L. Hershey, comp. 1947. 14p. (NP-3135)

5218
Geological Survey
A CATALOG OF STUDY MATERIAL OF RADIOACTIVE MINERALS. T. W. Stern. Oct. 1950. 81p. (TEI-129)

Specimens of radioactive minerals for which the Geological Survey has been collecting optical, x-ray diffraction, and other data are listed. The specimens are in the study collections of the U. S. National Museum, the Mineralogical Museum of Harvard University, and the Geological Survey. The listing does not include all specimens in these institutions, but it does include those specimens for which x-ray patterns can be made available as well as representative specimens from significant localities. In addition, references are given to material on deposit at the U. S. National Museum that has been described in the literature. Because of the rarity of much of the material listed, requests for study material must be considered individually.

5219
Geological Survey
SUMMARY OF THE RESEARCH WORK OF THE TRACE ELEMENTS SECTION, GEOCHEMISTRY AND PETROLOGY BRANCH, FOR THE PERIOD APRIL 1, 1948–DECEMBER 31, 1950. John C. Rabbitt. June 1951. 69p. (TEI-148-A)

Laboratory and related field studies in the mineralogic and petrologic investigations of radioactive minerals in the Florida phosphate, Northwest phosphate, Colorado Front Range, Colorado Plateau, black shale, and miscellaneous projects are reported, techniques used are described, and methods of recording mineralogical data are discussed. Purpose, results of investigations and plans are summarized on development of analytical methods for U, Th, Al, P, and other minerals and elements, criteria for accuracy of analytical methods, better immersion liquids for measurement of high refractive index, and improved spectrographic and radiometric techniques.

5220
Geological Survey
INTERIM REPORT OF GEOLOGIC INVESTIGATION, LOST CREEK SCHROECKINGERITE DEPOSITS, SWEETWATER COUNTY, WYOMING. L. R. Page. Oct. 1950. 4p. (TEM-183-A)

The location and geology of these U-bearing deposits are described briefly, and methods for prospecting for schroeckingerite are suggested.

TRACER APPLICATIONS

5221
Massachusetts Inst. of Tech.
THE ADAPTATION OF TRACER TECHNIQUES TO MINERAL ENGINEERING PROBLEMS. Oct. 31, 1950. 35p. (NYO-589; MITS-9)

A summary of the program on flotation of sphalerite with S^{35}-labeled mercaptans includes data for distribution of hexyl mercaptan in gas, water, and solid phases and estimates of its solubility in water, ionization constant, and vapor pressure. Work on kinetics of surface reactions in flotation has been concerned with a detailed study of the precipitation of sulfate and oxidation of S^{35}-labeled xanthate in aqueous and pyridine-aqueous solutions and with attempts to establish a satisfactory equilibration procedure. Results of tests on the volume of C^{14}-labeled aqueous dodecylamine acetate required to reach equilibrium adsorption on hematite are tabulated. Data obtained to date on the depression of pyrite in flotation as studied by determination of the amount of Ca^{45} adsorbed by pyrite in equilibrium with $Ca(OH)_2$ solutions of known concentration are summarized. Plans and preliminary experiments to investigate the liquid-gas interface with tritiated n-octyl alcohol are reported, a new counter being illustrated. Various techniques of possible use in investigating the adsorption of Na^+ ion on a quartz surface by the use of Na^{22} tracer are discussed. The application of β-particle-sensitive nuclear emulsions to the high-resolution autography of Na^{22} or Na^{24} self-diffusion in minerals is described. Radionuclides formed by thermal-neutron activation are tabulated in order of half-life and specific saturation activity.

5222
Massachusetts Inst. of Tech.
THE ADAPTATION OF TRACER TECHNIQUES TO MINERAL ENGINEERING PROBLEMS. A. M. Gaudin. Apr. 30, 1951. 50p. (NYO-593; MITS-11)

To aid in further investigations on flotation of Zn minerals with S^{35}-labeled hexyl mercaptan, a Brunauer-Emmett-Teller apparatus for measuring the surface area of mineral powders has been constructed; calibration and powder preparation are described. The effect of pH on the adsorption of dodecylamine acetate on hematite and the relation between the specific adsorption density and the contact angle (measured with a captive-bubble apparatus) have been investigated. The effect of O_2 in the analytical method used to measure the amount of S^{35}-labeled xanthate adsorbed on pyrite is discussed, and an adsorption curve for xanthate on pyrite is presented. Experimental results are reported indicating that the amount of Ca^{45} adsorbed in studies on the depression of pyrite in flotation depends on the extent to which the pyrite surface is oxidized. By comparing adsorption data and surface areas as determined with a B.E.T. apparatus, the per cent of pyrite surface covered by the Ca has been determined. Data on adsorption of Na^+ ion onto a quartz surface, as measured with Na^{22} tracer at various Na concentrations and pH values and in the presence of Li^+, Cs^+, Cl^-, and SO_4^{--} ions are tabulated. An apparatus by which the streaming potential of a porous quartz bed may be measured is described; eventual application to determination of surface coverage is intended. The solid-state diffusion of ions in silicate structures has been studied by deuteron activation. In addition to the reported progress for the quarter ending Mar. 31, 1951, brief summaries of the past year's activities on these projects are given.

5223
Massachusetts Inst. of Tech.
THE ADAPTION OF TRACER TECHNIQUES TO MINERAL ENGINEERING PROBLEMS. A. M. Gaudin. July 31, 1951. 37p. (NYO-876; MIT-12)

In the adsorption of dodecylamine acetate on hematite, contact-angle measurements on mineral sections prepared from both polycrystalline and monocrystalline hematite have been completed at concentrations of from 0.8 to 250 mg amine per liter by the use of a captive-bubble apparatus. Contact-angle data are tabulated and plotted. Hematite flotation is possible at a concentration of only 7 to 8 mg of amine per liter (pH6; contact angle 18°). In the adsorption of xanthate on pyrite in the concentration range 0.05 to 15 mg of xanthate per liter, the amount Y of xanthate in mg adsorbed per gram of pyrite is related to the concentration X of xanthate in solution in accordance with the function $Y = 0.031\ X^{0.26}$. Several series of flotation (adsorption) tests are reported using radioactive hexyl mercaptan and quartz

or zincite. The steps involved in making zeta potential measurements in flotation systems are enumerated, and test results on dilute NaCl solutions passing through quartz beds are tabulated. Self-diffusion studies, by methods described in NYO-593, of sodium in the minerals albite (sodium aluminum silicate) and microcline perthite (an intergrowth of sodium aluminum silicate and potassium aluminum silicate) were made at 1000°C. Respective preliminary values for the diffusion coefficients range from 4×10^{-10} to 2.6×10^{-9} cm²/sec and from 5×10^{-10} to 6.1×10^{-7} cm²/sec. In a preliminary study of the solubility of quartz in water, pile-irradiated ground quartz was agitated in water, and the activity of the latter was then measured. Sodium activity in the quartz made measurement difficult. The depression of pyrite in flotation by the presence of Ca ions was studied with Ca^{45}; preliminary data regarding the amount of Ca adsorbed by pyrite in equilibrium with a solution of given concentration are summarized.

PHYSICS

5224
Los Alamos Scientific Lab.
100-TON TEST; MEASUREMENT OF THE VELOCITY OF SOUND. H. H. Barschall and G. Martin. June 15, 1945. Decl. Nov. 23, 1949. 8p. (AECD-3225)

The velocity of sound at the time of the 100-ton shot at Trinity (N. Mex., site of the first atomic bomb test) was measured to be 1115.1 ft/sec. Values of blast pressure computed from the excess velocity are given, but are not considered as reliable. (auth)

5225
Carnegie Inst. of Tech.
MEASUREMENT OF THE DIELECTRIC CONSTANT OF MOLTEN SLAG. G. M. Anderson. Mar. 1, 1951. 15p. (AECU-1434)

Two methods of measuring the dielectric constant of molten slag are described and investigated. The first of these, the conventional standing wave method, is shown to be impractical for the range of conductivities expected. The second method utilizes the attenuation of the electromagnetic energy as it propagates into the slag [through an inserted wave guide]. This latter method appears to offer a reasonable chance of success if extreme accuracy is not expected. It suffers from the limitation that the conductivity must be known from some other source. (auth)

5226
Brookhaven National Lab.
TECHNICAL INFORMATION SERVICES AT ATOMIC ENERGY LABORATORIES. Dennis Puleston. [nd] 7p. (AECU-1473)

The technical information services provided at Brookhaven National Laboratory are described with the intent of presenting a general picture of a typical technical information organization at any one of the larger atomic energy research laboratories in the USA.

5227
Argonne National Lab.
THERMODYNAMIC FUNCTIONS ON THE GENERALIZED FERMI-THOMAS THEORY. Malcolm K. Brachman. July 18, 1951. 3p. (AECU-1556; UAC-411)

A mathematical treatment is given of the thermodynamic function based on the generalized Fermi-Thomas theory. The purpose of the report is to show that the pressure calculated from the free energy using the generalized Fermi-Thomas model for arbitrary temperatures agrees with that found by mechanical considerations based on the same model. An expression is obtained for the entropy and the specific heat.

5228
Brookhaven National Lab.
QUARTERLY PROGRESS REPORT; JANUARY 1–MARCH 31, 1951. June 1951. 104p. (BNL-103)

Separate abstracts have been prepared on the following sections of this report: Physics Department, p.3-46; Instrumentation and Health Physics Department, p.47-52; Decomposition of Water, Dilute Halide Solutions, [and H_2O_2 by High Energy X-rays], p.59-61; Chemistry, p.62-78; and Biology Department, p.86-93.

5229
Brookhaven National Lab.
PHYSICS DEPARTMENT, p.3-46 of QUARTERLY PROGRESS REPORT; JANUARY 1–MARCH 31, 1951. June 1951. 44p. (BNL-103(p.3-46))

Brief results are given of studies on the cross-over transition in the decay of Tc^{99m}; a new isomer, Y^{89m}; the disintegration scheme of Lu^{176m}; radiations from Sn^{119m}; γ rays from U^{234}; measurement of γ-ray energies of Cr^{51}. Mo^{101}, Tc^{101}, Ti^{101}, and Nb^{94m} with a scintillation spectrometer; decay of Ti^{205}; energy levels of B^{10}; and β and γ radiation of Al^{28}. A comparison of cross sections of D and H for 14-Mev neutrons is made and the γ excitation curve is plotted for $H^3(p,\gamma)He^4$. Studies on fast-neutron cross sections and level density indicate that the statistical model of the nucleus requires some revision. Techniques used with the slow-neutron chopper are described. The section on inelastic scattering of thermal neutrons elaborates on the interaction between neutrons and the modes of elastic vibration of solids. Technical details on instrumentation for work with neutron beams are given in reports on the fast chopper and on Co mirrors for neutron polarization, and on the index of refraction for neutrons. For measuring the mosaic structure of crystals, neutron diffraction has been used. A report on gravity acceleration of neutrons confirms the expected magnitude of the gravitational force. A report on high-energy disintegrations gives analyses of nuclear disintegrations by primary cosmic ray protons at different latitudes and includes work with laminated emulsions. In the production of neutral π mesons by the interaction of charged mesons with carbon nuclei the cross section is less than 1/7th of the geometric cross section. A charge renormalization in the Hartree approximation is given. An abstract of a reformulation of the theory of quantized fields by Julian Schwinger concludes the report. Here the conventional correspondence basis for quantum dynamics is replaced by a self-contained quantum dynamical principle from which the equations of motion and the commutation relations can be deduced. A section entitled Classification of Nuclear Isomers has appeared also as report AECU-1406.

5230
Columbia Univ.
PROGRESS REPORT; NUCLEAR PHYSICS LABORATORIES. W. W. Havens, Jr., Director. June 30, 1951. 33p. (CU-96)

The total neutron cross sections of Re, Ta, Ga, and Li have been obtained with the slow-neutron velocity spectrome-

ter. Plots show the results of measurements of the slow-neutron transmission of these elements. The capture slope and thermal cross section of Te have been determined. A capture resonance in Sr at 3.5 ev has been located using the immediate γ's from neutron capture as detector. Resonances in Cd at 27 and ~90 ev, and in Ba at 25 and 101 ev have been confirmed. Exploratory work has been carried out to obtain carrier-free P^{32} by means of a Szilard-Chalmers reaction on triphenylphosphine. A quick recovery amplitude discriminator (QRD) with a rise time less than 10^{-8} sec and recovery of 10^{-7} sec has been developed and modified to function on negative as well as positive pulses. Details of operation as well as circuit details are described. Also shown is a schematic of a multichannel coincidence circuit utilizing the QRD. Two inductive extinguishing circuits for Geiger tubes have been developed and are shown schematically. They are a medium-gain inductive circuit intended for use with a self-quenching tube and an improved high-gain inductive circuit suitable for use with nonself-quenching as well as self-quenching tubes. The β spectrum of Tl^{204} was examined with the magnetic solenoid spectrometer using both vacuum-evaporated and chemically deposited Tl nitrate sources. The spectrum has the "α" shape and an end point of 780 kev. Examination of the γ-ray spectrum of Tl^{204} showed the presence of an x ray of about 74 kev. The decay scheme of Tl^{204} is shown.

5231

Oak Ridge National Lab.

QUARTERLY PROGRESS REPORT FOR PERIOD ENDING MARCH 20, 1951. PHYSICS DIVISION. Seymour Bernstein, ed. July 24, 1951. 63p. (ORNL-1005)

Neutron-diffraction studies of Ti and Ce hydrides indicate definite structures. The coherent neutron-scattering cross sections of Ce and Ba were found to be 2.2 and 3.5 barns, positive phase, respectively. A model of the magnetic structure of MnF_2 and NiF_2 below 70°K is illustrated, together with the neutron-diffraction patterns for MnF_2. Improvements in the neutron-decay apparatus are reported. A new method based on changes in magnetic moments of paramagnetic salts for the measurement of absolute temperature and entropy below 1°K is described briefly. A 1.8×10^{-9}-sec excited state in Dy^{160} is reported. γ-ray spectra of the reactions $B^{11}(p,\gamma)C^{12}$, $D(p,\gamma)He^3$, and $T(p,\gamma)He^4$ are presented and discussed. A histogram of inelastic scattering of 14-Mev neutrons in Pb and brief statements of status of recalibration of the Oak Ridge standard pile and studies of physical behavior of Au films under bombardment with 200-kev protons are given. The luminescence responses to ultraviolet light and Po α particles of 22 neutron-sensitive phosphors containing Li are tabulated, and an apparatus to determine the crystal-growth properties of phosphors and to grow large crystals from the melt is described briefly. Pulse analyses of Cd^{109} and Eu^{152} x rays by a photographic-density technique are compared with results from a conventional pulse-height analyzer. Fermi plots, more accurate than those given in ORNL-940, of the β-ray spectra of Ag^{108} and Ag^{110} are presented. A brief statement is made of the development of a plane-mirror source of long-wavelength (>4 A) neutrons. The statuses of calculations by the theoretical physics group on angular correlation of internal-conversion electrons and γ rays and of three successive radiations in a nuclear cascade, hyperfine structure in Mn^{++}, energy-loss mechanism of slow ions, neutron-deuteron scattering, scattering and capture of slow neutrons, and isotropy of nuclear γ radiation are summarized.

5232

Tennessee Univ.

ENERGY CHANGES RESULTING FROM PLASTIC DEFORMATION (PROGRESS REPORT FOR SECOND AND THIRD QUARTERS). E. E. Stansbury. Aug. 1951. 4p. (ORO-42)

The first progress report (ORO-28; NSA 5-4145) on the investigation of internal energy changes resulting from plastic deformation pointed out that two major experimental problems had been encountered, namely, the accurate measurement of temperatures with thermocouples and the control of adiabatic conditions within the calorimeter. The problem of maintaining adiabatic conditions seems to have been adequately solved. Work is continuing on the thermocouple problem since prohibitive amounts of drift have been encountered. Accomplishments are reported briefly, and planned work is indicated.

5233

Radiation Lab., Univ. of Calif.

CERENKOV RADIATION FROM PROTONS AND THE MEASUREMENT OF PROTON VELOCITY AND KINETIC ENERGY. (thesis) R. L. Mather. May 22, 1951. 54p. (UCRL-1306)

Monoenergetic protons from the 184-in. cyclotron were incident at an angle to a sheet of glass in which they produced Cherenkov radiation. Perpendicular to the glass a Leica camera was placed to focus and record the radiation. A new method for calculating the energy of a proton beam was developed. By measuring θ, the angle between the proton beam and Cherenkov radiation, and n, the index of refraction of the glass, the kinetic energy E can be calculated by the relation

$$E = \mu c^2 \left(\frac{n \cos\theta}{(n^2 \cos^2\theta - 1)^{1/2}} - 1 \right)$$

where μ is the mass of the proton. This method gave results consistent with measurements by range in Cu and by meson production.

5234

Radiation Lab., Univ. of Calif.

PHYSICS DIVISION QUARTERLY REPORT; FEBRUARY, MARCH, AND APRIL, 1951. July 9, 1951. 24p. (UCRL-1380)

The design of a diffusion cloud chamber and its operation in the meson beam produced by the reaction $p + p \rightarrow \pi + d$ where 350-Mev protons bombard a polyethylene target are described. Results are discussed of an investigation of the π/μ meson mass ratio and of the energetics of meson decay. Two new radioactive nuclei, F^{18} and Al^{24}, with A = 4n, Z = 2n + 1 have been found in substances bombarded by the linear accelerator beam. The period of Al^{24} is 1.9 sec and its mass is 24.0070. F^{18} has a period of approximately 0.5 sec and a mass of 16.0168. Neutral meson yields from Be^9, B^{10}, B^{11}, C^{12}, H_2O, CCl_4, and Pb as targets in the proton beam of the cyclotron have been determined. A block diagram shows the arrangement of an apparatus and circuit for detection of high-energy photons. A measurement of the scattering cross section at 90° of 47-Mev π^+ mesons by C has yielded a value of $(1.7 \pm 0.5)\ 10^{-26}$ cm²/ster. The inelastic d-p scattering with 190-Mev deuterons has been studied. A strong correlation has been observed between the directions with which two protons emerge from a C or Li nucleus bombarded with 345-Mev protons. Measurements have been made on the angular distribution of 9.8-Mev protons scattered from He. A scintillation crystal γ counter has been built employing the features of low output capacity of the photomultiplier tube, differential input, regulated high-voltage supply, and a precision counting-rate meter for counts from 1 to 10,000 cts/sec. A typical set of curves of counts per second vs. photomultiplier tube gain for different γ energies is given. Two new probes for the 60-in. cyclotron are described. One was designed to

monitor the internal beam at the deflector radius of 25 in., having a range of 23 to 26½ in. from geometric center of the vacuum tank; the other probe was designed to move along the axis of the dees both vertically and horizontally. Both probes were designed to monitor the beam electronically.

5235
Radiation Lab., Univ. of Calif.
ON THE ANGULAR DISTRIBUTION AND THE POLARIZATION OF THE DEUTERON IN THE REACTION P + P→ D + π^+. K. M. Watson and C. Richman. July 12, 1951. 6p. (UCRL-1393)

Theoretical consideration is given to the contribution of the orbital S- and P- states of the meson, with respect to the deuteron, to the cross section for the reaction P + P→ π^+ + D. The degree of polarization of deuterons in this reaction has also been considered.

5236
Atomic Energy Research Establishment, Harwell, Berks (England)
RANGE OF FAST PROTONS IN MATTER. A. E. Taylor. Oct. 1950. 5p. (AERE GM/70)

The range-energy relation for protons in Be and in C has been computed from 2.5 up to 200 Mev (20-Mev intervals). These and the corresponding values for Pb are tabulated. A table of mean excitation energies per atom and per electron for 22 elements and air is included.

5237
Bartol Research Foundation, Franklin Inst.
EIGHTH SEMI-ANNUAL REPORT OF THE WORK OF THE BARTOL RESEARCH FOUNDATION OF THE FRANKLIN INSTITUTE. W. F. G. Swann, Director. Sept. 15, 1950. 158p. (NP-3049)

Separate abstracts have been prepared on the following sections of this report: Cosmic Rays, chap. 1; and Nuclear Physics, chap. 2: Bound with this report are a number of reprints of recent articles concerned in general with cosmic radiation.

5238
Bartol Research Foundation, Franklin Inst.
NUCLEAR PHYSICS, chap.2 of EIGHTH SEMI-ANNUAL REPORT OF THE WORK OF THE BARTOL RESEARCH FOUNDATION OF THE FRANKLIN INSTITUTE. W. F. G. Swann, Director. Sept. 15, 1950. 36p. (NP-3049(chap.2))

A proportional counter for detecting soft β particles is described. The 90° excitation functions for the reactions $B^{10}(d,\alpha)Be^8$ and $B^{11}(d,\alpha)Be^9$ have been determined by bombarding thin targets of isotopically enriched B and of normal B, and observing the reaction α particles with an A-filled proportional counter. Rh^{105} has been studied and the half life determined to be 36.8 hr. Plots show the absorption in Al of β rays and in Pb of the γ rays of Rh^{105}. The coincidence absorption absorption curve of Cd^{115} shows a maximum γ-ray energy of 1.10 Mev, and the Pb absorption curve shows that γ rays at 0.10 and 2.00 Mev are also present. The β-γ coincidence rate of Cd^{115} is shown to decrease to zero at 110 mg/cm² in Al, indicating a maximum β-ray energy of 0.38 Mev. A new method is described for measuring electron velocities in Geiger-counter gas mixtures. Reduction of coincidence time delays in Geiger counters has been investigated.

5239
THE INTERCONVERSION OF ENERGY NUMBERS. C. H. Douglas Clark. Proc. Leeds Phil. Lit. Soc. 5, 330-37(1950) Nov.

Tables are presented, enabling interconversions to be made between numbers measuring energy in different units. The best available values of the fundamental constants have been used. New units not previously considered are included. A separation of the units into two main classes is suggested. A correction in the earlier work has been made. (auth)

5240
AN INTERNATIONAL BIBLIOGRAPHY ON ATOMIC ENERGY, Vol. II, SCIENTIFIC ASPECTS. United Nations Atomic Energy Groups, Dept. of Security Council Affairs. New York, Columbia University Press, 1951. 880p.

An abstract appeared in Nucleonics 8, No. 6, 54(1951) June, and is reproduced here in its entirety.

This 880-page work contains 24,282 entries of technical books and articles on the scientific aspects of atomic energy published in all parts of the world from 1925–1949. Brief introductory essays by leading scientists serve to preface the five major sections of the bibliography which are as follows: Fundamental Nuclear Science; The Physics and Engineering of Nuclear Reactors; The Biological and Medical Effects of High-energy Radiations; Isotopes in Biology and Medicine; and Applications of Radioactive Tracers in Nonbiological Sciences and Technology.

ASTROPHYSICS

5241
National Standards Lab. (Australia)
PATH AND ENERGY OF A CHARGED PARTICLE IN A VARYING MAGNETIC FIELD. G. H. Godfrey. Oct. 1950. 14p. (PA-13)

A mathematical discussion of the path and energy of a charged particle in a varying magnetic field is given. The case considered is of a symmetrical magnetic field which is everywhere parallel to a given straight line, the intensity of the field at all points equidistant from the line being the same at a given instant. An example case is considered which might exist in the sun's atmosphere near a growing sun spot.

COSMIC RADIATION

5242
California Univ., Berkeley
THE ANGULAR DISTRIBUTION OF V°-PARTICLE DECAY PRODUCTS. W. B. Fretter. [nd] 3p. (AECU-1516)

In a series of 20,000 cloud-chamber photographs taken at sea level 37 V°-particles and 8 $V^{\pm}$-particles were observed. The cloud chamber is briefly described. In this study 26 V° events, in which the plane of the V° appeared to contain the point where the original event occurred, were analyzed on the assumption of V° → p + π^- and assumed mass values for V° of 2170 m_e and 2390 m_e. A difficulty appeared, in that the measured angles of emission are more nearly equal to each other than is to be expected when the masses of the particles differ as much as do those of a proton and meson. The possibility that the angular distribution may be distorted by the occurrence of some V° → π^+ + π^- processes is mentioned, but more consideration is given to the possibility of the three-body decay V° → p + μ + ν with coincidental coplanarity.

5243
Syracuse Univ.
AN UNUSUAL STAR IN CLOUD CHAMBER GAS. Erich M. Harth and Kurt Sitte. Apr. 1951. 5p. (NYO-708)

A photograph of an 8-prong star initiated in the gas of an argon-filled cloud chamber is shown. It appears that this is an example of an argon nucleus completely disrupting and forming seven α particles and a Be "fragment" nucleus.

5244
Bartol Research Foundation, Franklin Inst.
COSMIC RAYS, chap.1 of EIGHTH SEMI-ANNUAL REPORT OF THE WORK OF THE BARTOL RESEARCH FOUNDATION OF THE FRANKLIN INSTITUTE. W. F. G. Swann, Director. Sept. 15, 1950. 57p. (NP-3049(chap.1))

Cosmic-ray investigations have been made at very high altitudes at 69°N in a search for a diurnal variation of the intensity of the primary cosmic radiation and to study the horizontal intensity. Results are reported in detail of the determination of the differential intensity of protons at sea level using low-pressure G-M counters. A critical survey is made of certain theories concerning cosmic-ray phenomena and consists of (1) comments on Swann's (Phys. Rev. 43, 217(1933)) electromagnetic induction theory of cosmic-ray energies, together with comments on certain criticisms which have been raised concerning the theory, (2) comments on the significance of the relation $-(E_\theta - \dot{r}H_z/c) \geq 0$, for the acquirement of energy by a charged particle, and (3) a discussion of the binding of magnetic fields to moving matter and the difficulty of realizing a rate of change of magnetic induction in a highly conducting medium. A plan (accompanied with theory) is proposed for determining the mean life of μ mesons as a function of energy. There are discussed, in some detail, studies of the absorption of cosmic rays including (1) an investigation of abnormalities in the absorption curve of Pb, (2) the relationship between spectral distribution curve and absorption curve, and (3) experiments on the absorption in Pb under different thicknesses of water.

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

5245

Argonne National Lab.

INVESTIGATION OF COLOR CENTERS IN SINGLE CRYSTALS. C. J. Delbecq, Peter Pringsheim, R. Casler Voreck, and P. J. Yuster. Dec. 1950. 23p. (AECU-1533; UAC-405)

Data on the far-ultraviolet absorption bands observed in KI crystals containing color centers are summarized. Changes in the absorption spectra of KI due to temperature, photochemical coloration, and additive coloration are shown graphically. The origin of the absorption bands is discussed, and some observations on the purity of the KI used are given. Samples of commercial synthetic NaCl and natural rocksalt have been compared with respect to behavior of their F-centers produced by exposure to soft x rays; the results are presented in some detail. 11 figures.

5246

Argonne National Lab.

IMPROVEMENTS IN THE X-RAY REFLECTION METHOD FOR THE QUANTITATIVE DETERMINATION OF PREFERRED ORIENTATIONS. Warren P. Chernock and Paul A. Beck. Aug. 1951. 27p. (AECU-1574; UAC-423)

The limitations of the Schulz quantitative x-ray-reflection method (J. Applied Phys. 20, 1030(1949)) for determining pole figures are discussed. Improvements of the method are presented together with descriptions of a specimen-alignment jig and a specimen-scanning mechanism. 17 figures.

5247

Argonne National Lab.

IDENTIFICATION AND CRYSTAL STRUCTURE OF PROTACTINIUM METAL. W. H. Zachariasen. Feb. 1951. 8p. (ANL-4632)

An x-ray-diffraction examination has been made of the Pa compounds produced by the reduction of Pa tetrafluoride with Ba. Investigation showed the presence of small amounts of PaO_2 and of two other phases identified as PaO and as Pa metal. Results indicate that Pa metal is tetragonal body-centered with two atoms in a cell of dimensions — $a_1 = 3.925 \pm 0.005$ A, and $a_3 = 3.238 \pm 0.007$ A, the calculated density being 15.37 ± 0.08. Each metal atom has ten next neighbors; eight are at a distance of 3.212 A and two are at 3.238 A. The metallic radius of Pa for coordination number twelve is 1.63 A. PaO has the NaCl type of structure with $a = 4.961 \pm 0.003$ A and a calculated density of 13.43.

5248

Atomic Energy Research Establishment, Harwell, Berks (England)

REFLECTION OF NORMALLY INCIDENT PLANE POLARIZED LIGHT BY ABSORBING CRYSTAL. J. Woodrow. Apr. 5, 1951. 23p. (AERE-E/M-36 & Addendum I and II)

The optics of an absorbing crystal is outlined, and the reflection of a normally incident and plane-polarized beam is considered. In the case of crystals belonging to the triclinic, monoclinic, and orthorhombic systems, the reflected beam is generally elliptically polarized, and can be markedly so. If the principal reflectivities and principal phase shifts on reflection are approximately equal, the reflected beam is approximately plane-polarized. In the case of uniaxial crystals, the reflected beam is again generally elliptically polarized; if the principal phase shifts are approximately equal or both small, the reflected beam is approximately plane-polarized. Finally cubic crystals are optically isotropic, and the reflected beam is plane-polarized and uniradial. (auth)

5249

Army Chemical Center, Md.

LUMINESCENT SOLIDS (PHOSPHORS), paper 6 of REPORT OF SYMPOSIUM IV; CHEMISTRY AND PHYSICS OF RADIATION DOSIMETRY [HELD AT THE] ARMY CHEMICAL CENTER 18, 19, and 20 SEPTEMBER 1950; PART I—UNCLASSIFIED PAPERS. H. W. Leverenz. [nd] 22p. (NP-3237(paper 6))

The theory of luminescence is discussed in some detail. Exemplary synthesis of phosphors and the effects of impurities on the phosphor crystals have been considered. The pronounced influence of structural changes on the luminescence of solids is shown. Two complementary types of simplified energy-level diagrams have been devised to give a generalized picture of the mechanism of luminescence. Luminescence emission spectra as well as luminescence efficiency and luminescence output of phosphors are discussed. (See also Science 109, 183-95(1949) Feb. 25; NSA 2-1420.)

5250

Army Chemical Center, Md.

THERMOLUMINESCENCE AND RELATED PROPERTIES OF CRYSTALS, paper 8 of REPORT OF SYMPOSIUM IV; CHEMISTRY AND PHYSICS OF RADIATION DOSIMETRY [HELD AT THE] ARMY CHEMICAL CENTER 18, 19, and 20 SEPTEMBER 1950; PART I—UNCLASSIFIED PAPERS. Farrington Daniels. [nd] 9p. (NP-3237(paper 8))

The phenomenon of thermoluminescence of crystals has been described together with explanations and methods of measurement. Radiation dosimeters are proposed, which depend on the intensity of light emitted when a crystal is heated in the dark after exposure to γ radiation. A typical thermoluminescent glow curve is shown for LiF after exposure to γ rays.

GASES

5251

Knolls Atomic Power Lab.

LOW TEMPERATURE SECOND VIRIAL COEFFICIENTS FOR FOR A 6-12 POTENTIAL. Leo F. Epstein and Glenn M. Roe. July 25, 1951. 8p. (AECU-1548)

A method is given for evaluating low-temperature second virial coefficients B(T) for a gas with a Lennard-Jones 6-12 potential. Three tables are included for simplification of use of the expression for B(T) under certain specified conditions.

5252

Radiation Lab., Univ. of Calif.

THE GASEOUS SPECIES OF THE BORON—BORIC OXIDE SYSTEM. Alan W. Searcy. July 20, 1951. 10p. (UCRL- 1404)

The reaction between B and Be oxide has been investigated at 1900°K by the Knudsen effusion method. From the results the heat of formation of BO gas is calculated to be 4.5 ± 3 kcal/mole, and it is shown that boric oxide vaporizes without decomposition to lower oxides. Calculations based on experiments in the literature lead to a heat of sublimation of B of 131 ± 4 kcal/mole and to 8.0 ± 0.2 ev for the dissociation energy of BO gas. The vapor pressure of ZrO_2 is 2.5×10^{-7} atm at 2073°K. (auth)

INSTRUMENTS

5253

Los Alamos Scientific Lab.

FREQUENCY MODULATION SYSTEM. Vincent O'Gorman. [nd] Decl. Jan. 30, 1950. 3p. (AECD-2948; LADC-744)

A frequency-modulation system is described which provides, in combination with the system for receiving a frequency-modulated signal, means for eliminating amplitude variations and for producing a satisfactory band-pass filter characteristic.

5254

Tennessee Eastman Corp.

A SPARK OUTAGE RECORDER FOR HIGH VOLTAGE SYSTEMS. Murray Bevis and J. D. Trimmer. Apr. 1, 1947. Decl. May 29, 1951. 7p. (AECD-3172; Y-B1-93)

A detailed description and simplified wiring diagrams are presented of a recording, and of an integrating, outage measuring instrument for use in d-c high-voltage systems. The outage recorder gives a record on an Esterline-Angus recording milliammeter, of percentage outage time covering the immediately preceding interval of time. The outage integrator totalizes the outage time on a counter. A photograph of the two instruments is shown. Both are equipped with a time meter to totalize the time during which the overload breaker in the line to the high-voltage supply is open, thus measuring "breaker outage," and with a relay which kills the spark-outage measurement during the same time, so that breaker outage and spark outage are measured

5255

Pupin Physics Labs., Columbia Univ.

APPLICATION OF X-RAY IN DETECTING SMALL AMOUNT OF T-METAL. L. J. Rainwater, C. S. Wu, L. C. Aamodt, and W. W. Havens, Jr. Mar. 30, 1946. Decl. June 19, 1951. 16p. (AECD-3181; A-3851; DR-728)

The General Electric model KX-10 x-ray unit has been considered from the standpoint of portability, energy range, power-output range, and radiation shielding. The design and operation of an x-ray voltage monitor is described. This monitor acts as a source stabilizer and is essentially an ion chamber used to detect the change in x-ray transmission through thick metal plates with the change of x-ray voltage.

5256

Radiation Lab., Univ. of Calif.

COMPARATIVE TESTS OF HIGH VOLTAGE RESISTORS USED FOR VOLTMETER BLEEDERS. Carl T. Grauer. June 19, 1944. Decl. July 6, 1951. 12p. (AECD-3222; RL-7.6.7)

Tests were made for the purpose of determining the accuracy and permanency of various types of high-resistance bleeders and their resistance variation during use over a period of approximately 6 months. All resistors were mounted on an insulated test rack and paralleled on a high-voltage bus. A Weston and a Simpson meter were connected in series on the grounded end of each bleeder, and a 10,000-ohm grounding resistor was connected across the two meters for safety purposes. The resistance of each bleeder was measured regularly and recorded on a time basis. Suitable resistances, listed in order of desirability, are Westinghouse Sectional Resistors; Shallcross Akra-Ohm Resistors; International Resistance Co., Type MVR; Shallcross Taylor-Type XR-5 Resistors (unreliable operation); International Resistance Co., Type BT2 (considerable variation).

5257

Argonne National Lab.

SENSITIVE LEAK CONTROL. M. H. Mueller and R. B. Bilinski. Apr. 1951. 2p. (AECU-1365; UAC-382)

A diagram of a simple device designed for controlling the leak into a gas x-ray tube and other such applications is described. The control is accomplished by varying the pressure applied to a series of alternate rubber and metal washers.

5258

Argonne National Lab.

A PHOTOELECTRIC SETTING DEVICE FOR A SPECTRUM PLATE COMPARATOR. Frank S. Tomkins and Mark Fred. May 1951. 11p. (AECU-1396; UAC-386)

A device for making comparator settings by photoelectric scanning of spectrum line images is described. The fiducial position is determined by matching mirror-image oscilloscope traces of the line contour. This method combines the advantages of increased speed, precision, objectivity of setting, and decreased eye and nervous strain on the operator. The device is readily adaptable to comparators of the fixed microscope-moving plate type, and conversion from photoelectric to visual setting can be accomplished in a few minutes. (auth).

5259

Brookhaven National Lab.

A MAGNETIC ORIENTATION DEVICE. Serge E. Golian and Edward G. Reilly. [nd] 16p. (AECU-1405)

A light-weight, low-current-drain system for the geomagnetic orientation of experimental equipment during a high-altitude balloon flight is described. The system is specifically designed to keep nuclear emulsions oriented to within ±5° of a chosen geomagnetic heading. The error detector consists of a high-impedance a-c bridge, two of whose arms are electrolytic resistance paths in ethyl alcohol. Deviation of a compass needle, immersed in the electrolyte, from a chosen "on-course" line unbalances the bridge. A correcting motor is started when the off-course deviation unbalances the bridge to a sufficient predetermined extent. Direction of motor rotation is determined by the sense of the error. Quiescent power drain is 1.4 w. Motor operation increases this drain by 4 w. Flight analysis of orientation is made possible by an integrating camera. Some control characteristics are given. (auth).

5260

North Carolina Univ.

THE DEVELOPMENT OF ELECTROMECHANICAL EQUIPMENT TO FACILITATE THE SEARCH FOR EVENTS IN NUCLEAR EMULSIONS. [nd] 2p. (AECU-1524)

A preliminary report of this scanner appeared in Rev. Sci. Instruments 22, 113-14(1951) Feb. New features which have been incorporated into the completed mechanism are briefly summarized in this progress report. A new design for the reciprocating-gear take-off yields a triangular wave-pattern for the vertical motion of the objective. This permits a uniform scanning in depth simultaneously with uniform lateral motion of the emulsion. The mechanical drive may be stopped, decoupled, reversed, and reset at any time during the operation. Interchangeable reciprocating gears permit the observation in total thickness of emulsions from 50 to 400 μ. The field of view is projected on a screen for viewing directly with unaided eyes. It is stated that the technique of identification of particles by multiple scattering has been correlated successfully with range-energy determinations so that particles with one or

two elementary charges and masses up to that of α particles can be rapidly identified by simple methods which depend upon well-established theoretical formulae for multiple scattering of elementary charged particles in matter.

5261

Arkansas Univ.

LOOP-LINE WINDOWLESS FLOW GEIGER COUNTER. P. E. Damon. [nd] 12p. (AECU-1542)

The loop-line windowless flow Geiger counter described is of simple and rugged design. The anode is a wire loop and the cathode includes a grounded line wire which electrically shields the sample. The line wire, when properly placed, provides stability and freedom from spurious effects due to the accumulation of a charge on the sample. The geometry is essentially 2π. The instrument may be used for counting of α as well as soft β particles. It is self-shielded. (auth)

5262

Brookhaven National Lab.

AN AIR-BORNE DENSITOMETER FOR SMOKE CONCENTRATION MEASUREMENTS. R. V. Dvorak and R. L. Chase. [nd] 13p. (AECU-1582)

A simple, light-weight, split-beam optical smoke densitometer is described. The instrument is sufficiently light (4.25 lb) and rugged to be carried aloft by a captive balloon for the measurement of atmospheric smoke, stack effluent dilution, etc. Concentration of oil-fog aerosols as low as 0.92 mg/m^3 and as high as ~170 mg/m^3 have been measured.

5263

Argonne National Lab.

PROGRESS REPORT ON THE ARGONNE-OAK RIDGE DIGITAL COMPUTER. W. A. Birge, E. W. Burdette, A. W. Burks, J. C. Chu, D. A. Flanders, D. H. Jacobsohn, R. F. Kramer, and L. C. Merrill. Mar. 5, 1951. 103p. (ANL-4600)

The proposed components, techniques in design and experimentation, schemes for logical synthesis, and the underlying principles of the Argonne-Oak Ridge digital computer are described in some detail.

5264

Los Alamos Scientific Lab.

SERVO FURNACE VOLTAGE CONTROL UNIT. John Buchen. Nov. 28, 1950. 11p. (LA-1253)

The Servo Furnace Voltage Control Unit, model FC-2, was designed to replace a motor-driven variac voltage control on a furnace which is used in studies of specific heat of metal alloys. A discussion, including charts and photographs, of the operation and design of the equipment is presented.

5265

Palmer Physical Lab., Princeton Univ.

MULTIPLE SCATTERING CORRECTIONS FOR COLLIMATING SLITS. E. D. Courant. June 5, 1951. 15p. (NYO-969)

When a beam of charged particles passes through a collimating aperture the transmitted beam contains some particles which have traversed some of the material of the diaphragm. Approximate corrections to the effective size of the aperture are calculated. They are found to be very small for protons of energies of the order of 20 Mev, but appreciable at higher energies. Numerical values of the various corrections are tabulated for protons of 20 Mev passing through slits made of Al and Au with incident angles of 0 and 2° and taper angles of 0 and 2°. Corrections for Al are given at 20 Mev, 300 Mev, and 3 Bev, assuming in each case that the energy resolution is one-fourth of the incident energy.

5266

Oak Ridge National Lab.

THE DESIGN AND CONSTRUCTION OF AN ICE CALORIMETER. R. F. Redmond and J. Jones. Aug. 27, 1951. 23p. (ORNL-1040)

An isothermal ice calorimeter is described for use in obtaining heat capacity data within ±5% in the temperature range 100 to 1000°C. Relative enthalpies are measured by the amount of volume change that occurs in a two-phase ice-water mixture which gains heat from a heated sample. Using a synthetic sapphire calorimetric standard the calorimeter was checked for performance and was found to give heat capacity values with an accuracy greater than 95%. (auth)

5267

Radiation Lab., Univ. of Calif.

A LIQUID HYDROGEN TARGET. Leslie Cook. Nov. 6, 1950. 11p. (UCRL-990)

A description is given of a target built for the bombardment of liquid H. It has been used in several experiments (not discussed in this report) in the program of investigating mesons produced by x rays from the Berkeley synchrotron. The liquid H, in a stainless steel flask, was surrounded by an evacuated jacket containing a heat shield maintained at the temperature of liquid N. The liquid level was indicated by a counterweighted float system.

5268

Radiation Lab., Univ. of Calif.

TESTS ON A HIGH CURRENT R. F. JOINT IN VACUUM. Charles B. Wharton. July 25, 1951. 13p. (UCRL-1426)

A r-f joint tester has been designed to determine the relative heating and tendency toward arcing at high r-f current density (100 amp/linear in.) of a circular Cu butt joint in vacuum using several types of inserts and at various amounts of axial loading, ranging from a very small contact pressure to one of 1400 lb/linear in. of joint. A description is given of the oscillator and associated equipment as well as of studies of joint heat dissipation of a circular Cu butt joint as a function of contact pressure and r-f current density.

5269

[Atomic Energy Research Establishment, Harwell, Berks. (England)]

RISE TIMES OF PULSES FROM PROPORTIONAL COUNTERS TYPE 1077B. P. Holton and J. Sharpe. Mar. 1950. 6p. (AERE-EL/M-39)

The rise curve of a proportional counter appears to be fairly accurately described by a theoretical expression. The fraction F of the maximum voltage produced by a point source is given, for any time t, by $F = 1/(2 \log r_2/r_1) \log (1 + t/t_0)$. Here r_1 and r_2 are the radii of anode and cathode, respectively, and t_0 is a constant dependent on the geometry, voltage, and particular gas. Suitable summation takes into account the orientation and distribution of ionization of the track and the drift time of electrons in the gas. The mean collection time for ionization produced by a flat α source in a counter, type 1077B, will be about 1 μsec in argon and about one-third of this time in methane.

5270

Atomic Energy Research Establishment, Harwell, Berks. (England)

PHOTOMULTIPLIER TRANSMISSION DENSITOMETER FOR DENSITY RANGE 0-6. E. D. Dyson and J. Redfearn. Mar. 1951. 12p. (AERE-HP/R-657)

A new type of transmission densitometer is described, using a single light source and single 931 photomultiplier tube. The instrument reads densities of 0.5 to 4.0 on one scale with a uniform accuracy of 0.02 of density. It can be quickly adjusted to give a density scale of 0 to 6. It is used for sensitometry of radiation monitoring films, and measures the entire range of density which the Ilford Industrial A x-ray film can produce (representing 0 to 100 r of γ-ray dosage). Design considerations and constructional details of the instrument are given. (auth)

5271
Atomic Energy Project (Canada)
NOTES ON TUBE CATHODES AND INTERFACE RESISTANCE. W. J. Battell. May 3, 1951. 7p. (CREL-474)

The performance of receiving-type tubes such as 6AK5 and 6AU6 is affected by "sleeping sickness," "activation" or "forming" of oxide-coated cathodes, and temperature. These effects and optimum operating conditions are discussed. No new experimental data are given.

5272
National Bureau of Standards
MODEL VI MINIATURE I-F AMPLIFIER. Robert K-F Scal and Clinton O. Lindseth. Mar. 1, 1951. 17p. (NBS-1006)

A miniature intermediate-frequency amplifier is described with the emphasis on the constructional aspects. The usual problems encountered in miniature equipment of this type, such as high internal temperature and design of suitable components, are discussed. Major emphasis is placed on making the amplifier as producible as possible. The chief contribution toward this end is the use of separately mounted and easily wired subassemblies. (auth)

5273
National Bureau of Standards
QUARTERLY PROGRESS REPORT OF THE OFFICE OF BASIC INSTRUMENTATION FOR THE QUARTER ENDING MARCH 31, 1951. [nd] 27p. (NBS-1010)

Brief summaries are presented describing briefly the design and development of instruments including (1) a Ba titanate accelerometer (2) cathode-ray-oscillograph beam-intensification circuit, (3) pneumatic instruments, (4) a magnetic-type mass spectrometer suitable for the analysis of solids, (5) pulsed photomultiplier particle and light detector, and (6) thickness gage for measuring thickness of metallic coatings. Studies have also been made to determine the performance characteristics of the mutual-inductance transducer and the spring transducer.

5274
Sloane Physics Lab., Yale Univ.
STUDY OF A PROTON ACCELERATOR (Technical Report No. 5). Michael J. Ozeroff. May 23, 1951. 24p. (NP-3192)

A resonant-cavity proton accelerator designed as a high-intensity source of γ rays and neutrons was tested. The major problems involved in the study are discussed in detail. The design of the ion source was difficult in that it had to meet two conflicting requirements—high current, in order to give a useful beam intensity, and low gas pressure, so as not to throw the cavity out of resonance by ions formed within the gap. It was found possible to operate the accelerator at low currents, of the order of 10 μa, and to produce γ rays from boron and fluorine. At higher useful currents a gas discharge would effectively short-circuit the cavity.

5275
Department of Mines and Technical Surveys (Canada)
USE OF HIGH VACUUM TUBE AS A GRID CONTROLLED RECTIFIER IN STABILIZED HIGH VOLTAGE POWER SUPPLIES; RADIOACTIVITY DIVISION. (Topical Report No. TR-86/51). J. E. Wilson. July 18, 1951. 20p. (NP-3269)

For high-voltage, low-current applications such as a Geiger counter or photomultiplier, the functions of rectifier and series impedance can be combined with a resulting economy of components and space. Such a simplified regulated high-voltage supply is described, requiring one less tube and one less insulated filament winding than the more conventional circuit but delivering an over-voltage surge when first switched on. A thermostatic delay relay included in the primary of the high-voltage transformer removes the surge but adds an extra tube.

5276
Ministry of Supply (Great Britain)
AN IMPROVED DOUBLE CONE FILTER FOR SAMPLING PARTICULATE CLOUDS. D. Thorp. Mar. 29, 1951. 3p. (NP-3293)

A short account is given of the redesign of a double-cone filter (using filter paper, asbestos paper, or other material) for atmospheric sampling.

5277
Radiochemical Center, Amersham, Bucks. (England)
PHOTOELECTRIC TIMING EQUIPMENT FOR USE WITH GAMMA-RAY ELECTROSCOPE. J. Bryant and M. Michaelis. Jan. 1951. 30p. (RCC-R/7)

An apparatus is described for timing the fall of an electroscope leaf over a given distance. As the leaf falls, a projected magnified image of it successively interrupts light falling on two photocells through narrow slits. The resulting electrical signals from these cells respectively open and close an electronic switch which controls the passage of timing pulses to a scaling unit. The instrument is operated from the mains and includes single-push-button resetting facility. Compared with manual timing by visual observation and stop-watch, the equipment described eliminates the observers' personal error, facilitates remote operation, and provides greater accuracy of measurement. A method for stabilizing the projector light source is described in an Appendix. The light intensity of the incandescent lamp is kept constant to within $\pm 2.5\%$ for simultaneous voltage and frequency variations of the mains supply voltage. (auth)

5278
ELECTRONIC EQUIPMENT FOR DETECTION AND STUDY OF IONIZING PARTICLES AND RADIATIONS. R. Segovia, F. Verdaguer, and A. Tanarro. Anales real soc. españ. fís. y quím. 47A, 29-34(1951) Jan.-Feb. (In Spanish)

Circuit diagrams and construction details are given of instruments used for the testing of Geiger counters at the Institute of Optics of the Spanish Superior Council for Scientific Investigation and at the University of Madrid.

ISOTOPES

5279
Chicago Univ.
THE ISOTOPIC COMPOSITION OF TRACE QUANTITIES OF LEAD AND CALCIUM. (dissertation) Claire Patterson. May 11, 1951. Decl. June 8, 1951. 35p. (AECD-3180; ANL-MGI-33)

A colorimetric method for the estimation of trace amounts of Pb in iron meteorites and isotopic-dilution methods for determination of Pb in mineral separates (perthite, sphene, a and zircon) from a Canadian Shield granite and Ca in sylvite (KCl), using Pb^{208} and Ca^{48} tracers, respectively, are presented in detail. The concentration of Pb in the metal phase of the Cañon Diablo meteorite was found to be only 0.05 ± 0.03 μg/g, in contrast to values of from 30 to 100 μg/g reported for this and other meteorites by Noddack and Noddack (Z. physik. Chem. 154A, 207(1931)). The isotopic composition of Pb in the granite minerals and the radioactive decay constants of K^{40} in the sylvite also were determined. Application of this information to geological and cosmological age calculations is discussed.

5280
Los Alamos Scientific Lab.
MASS-SPECTROGRAPHIC STUDIES OF IRRADIATED U^{235} ENRICHED U SAMPLES. D. Williams and P. Yuster. Jan. 24, 1945. Decl. July 12, 1951. 7p. (AECD-3198; LADC-985)

A search was made for the possible presence of U^{236} formed by neutron capture by U^{235}. A graph is shown of the

mass spectrum of UF_5^+ ions formed by electronic bombardment of UF_6, the U being enriched in U^{235}. Peaks may be observed at mass numbers 333, 330, and 329 (corresponding to U^{238}, U^{235}, and U^{234}), and a small "bump" appears at 331. Another graph shows the high-mass side of the U^{235} peak under three different conditions of collector-slit width and source "tuning." The average ratios of U^{235} to U^{236} from measurements on two samples are, respectively, 1950 and 2500. It is possible but very unlikely that the 331 peaks are due to a fluorocarbon impurity. The estimated irradiation of the material was 3.5×10^{18} neutrons/cm^2. Using this value and the measured concentration of U^{236}, the capture cross section of U^{235} is computed as 128 barns.

5281
Carbide and Carbon Chemicals Co., Y-12
NEW DATA ON ISOTOPE SHIFTS IN URANIUM SPECTRA U^{238} AND U^{234}. D. D. Smith, G. L. Stukenbroeker, and J. R. McNally, Jr. June 10, 1949. Decl. July 30, 1951. 4p. (AECD-3218; Y-433)

The relative positions at 4244 A of U^{238} and U^{234} as well as previously reported (Long and Smith, CEW-TEC B-4.380.121; Burkhart, Stukenbroeker, and Adams, (Phys. Rev. 75, 83(1949), NSA 2-891)) U^{233}, U^{235}, and U^{238} are shown. The regularity of line shift between isotopes which differ in mass by two units is apparent. Tabular data illustrate this regularity as being approximately 0.149 A per two mass units.

5282
Oak Ridge National Lab.
URANIUM GAMMA SPECTRUM. P. R. Bell, R. C. Davis, J. E. Francis, and Judith M. Cassidy. July 20, 1951. Decl. Aug. 23, 1951. 9p. (AECD-3224; CF-51-7-86)

The natural γ radiations from U^{234}, U^{235}, and U^{238} have been studied by means of a scintillation spectrometer. The energies and intensities of the γ rays observed are shown in tabular and graphical form.

5283
Argonne National Lab.
CROSS-OVER TRANSITION IN Te^{123}. Bernard Hamermesh and Virginia Hummel. Aug. 1, 1951. 3p. (AECU-1570; UAC-424)

A sample of high enriched Te^{122} has been irradiated in the Argonne heavy-water–moderated reactor for the purpose of investigating the cross-over transition in Te^{123}. Pulse-height distributions corrected for background are plotted. An upper limit of 0.5% has been set as the value of the cross-over ratio.

5284
Isotopes Div., AEC
CONTROLS EXERCISED BY THE ATOMIC ENERGY COMMISSION IN DISTRIBUTION OF RADIOACTIVE ISOTOPES, paper 15 of HEALTH PHYSICS INSURANCE SEMINAR; [FEBRUARY 6–10, 1950]. Nathan H. Woodruff. Mar. 12, 1951. 14p. (TID-388(paper 15))

The present membership of the Advisory Committee on Isotope Distribution is listed, and the operation of the Committee in controlling by allocation the distribution of radioisotopes is discussed. Form AEC-313, application for radioisotope procurement, and the form for acceptance by the AEC of terms and conditions for order and receipt of by-product materials (radioisotopes) are illustrated and discussed line-by-line. Work of the Advisory Field Service Branch is summarized.

5285
Radiation Lab., Univ. of Calif.
HEAVY ELEMENT DECAY SCHEMES WITH ALPHA-GAMMA AND ALPHA-ELECTRON COINCIDENCE COUNTING. (thesis) Charles Anton Prohaska. Aug. 1951. 72p. (UCRL-1395)

A detailed description is given of a coincidence apparatus for measuring both α-γ and α-electron coincidences. From data obtained with this apparatus, decay schemes are postulated from Am^{241}, Cm^{242}, Th^{230}, Pa^{231}, and U^{233}. Internal conversion coefficients of these elements calculated from coincidence data are tabulated. 33 references.

5286
Oak Ridge National Lab., Y-12 Area
ELECTROMAGNETICALLY ENRICHED ISOTOPES. C. P. Keim, C. E. Normand, and Boyd Weaver. June 30, 1951. 63p. (Y-783)

5287
Atomic Energy Research Establishment, Harwell, Berks. (England) and Radiochemical Centre, Amersham, Bucks. (England)
RADIOACTIVE MATERIALS AND STABLE ISOTOPES CATALOGUE NO. 2. Oct. 1950. 111p. (NP-3095)

ISOTOPE SEPARATION

5288
Oak Ridge National Lab., Y-12 Area
MASS SPECTROMETER STUDIES OF COMPOUND CRACKING PATTERNS. Russell Baldock and John R. Sites. Apr. 20, 1951. 14p. (Y-759)

Report is made of preliminary investigations directed toward evaluating calutron charge materials by means of a 60° mass spectrometer. The compound under consideration is introduced into the mass spectrometer, and the ion current due to each of the fragments or species formed is plotted as a function of the mass of the fragments. This plot, called a "cracking pattern," gives a display of the relative abundance of the ions formed due to ionization and dissociation by the 75-v electrons. The general discussion is supported by cracking patterns of WCl_6, $VOCl_3$, and VOF_3.

5289
Oak Ridge National Lab., Y-12 Area
MASS SPECTROMETER STUDIES OF THE DISSOCIATION OF SOME METAL CARBONYLS. Russell Baldock and John R. Sites. Apr. 30, 1951. 14p. (Y-761)

A mass-spectrometer method is discussed for evaluating the suitability of compounds for use in electromagnetic separation of isotopes. Preliminary work on $W(CO)_6$, $Fe(CO)_5$, $Ni(CO)_4$ is presented. Photographs of equipment and cracking pattern charts for slow electrons for the above-named metal carbonyls are included.

5290
Oak Ridge National Lab., Y-12 Area
ELECTROMAGNETICALLY ENRICHED ISOTOPES; INVENTORY MAY 31, 1951. C. P. Keim, C. E. Normand, and Boyd Weaver. May 31, 1951. 66p. (Y-772)

This inventory lists the isotopes which have been concentrated electromagnetically, along with the completed information on their enriched abundances, and the element weights and product forms available in milligram quantities to users on Atomic Energy Commission projects and in university and industrial laboratories. (auth)

5291
Mellon Inst. of Industrial Research
MEMORANDUM TO DR. W. A. GRUSE ON ECONOMIC EVALUATION OF THE SWEEP DIFFUSION PROCESS AS APPLIED TO THE PRODUCTION OF CONCENTRATED CARBON 13. M. T. Cichelli. Mar. 1949. 43p. (NP-3157)

MASS SPECTROGRAPHY

5292
Argonne National Lab. and Chicago Univ.
SUPPRESSION OF SPURIOUS IONS IN THE MASS SPECTROMETER. D. C. Hess, G. Wetherill, and M. G. Inghram. June 7, 1951. 5p. (AECU-1440; UAC-395)

A study of one of the mechanisms of formation of background ions in mass spectrometers is reported. This mechanism is of prime importance in sources depending on surface ionization and is of somewhat less importance in the electron-bombardment source. Methods suggested for suppression of these spurious ions include the addition of a suppressor grid, use of successive deflection plates operated at different potentials, or operation of the source in a strong magnetic field.

5293

Wesleyan Univ.

MASSES OF Kr^{82}, Kr^{84}, Xe^{129}, and Xe^{132}. H. E. Duckworth and Cort L. Kegley. May 30, 1951. 6p. (NYO-979)

The masses of the isotopes of Kr and Xe have been measured by the mass-spectrographic doublet method. A list of the new mass values is given as follows:

Nuclide	Mass
Kr^{82}	81.93843 ± 0.00029
Kr^{84}	83.93850 ± 0.00029
Kr^{86}	85.93658 ± 0.00024
Xe^{129}	128.94536 ± 0.00026
Xe^{132}	131.94727 ± 0.00060

5294

Commissariat à l' Énergie Atomique

A MASS SPECTROMETER CORRECTED FOR ANGULAR ABERRATION. (In French) Philip Bernard-Levy, Charles Cassignol, and J. Moreau. June 1951. 17p. (CEA-80)

Improvements were made in the design of a mass spectrometer described in Report No. 50 of the French Atomic Energy Commission. Even in its new form the instrument presents defects, either inherent in the original conception or due to practical limitations during the construction, which will prevent its universal use for quantitative determinations. Special attention was given to a study of the behavior of beams of small aperture and to the correction of the angular aberration by means of a large-aperture source.

MATHEMATICS

5295

Kenyon Coll.

LIMIT-REPRESENTATION OF LINEAR, EVEN DISCONTINUOUS FUNCTIONALS IN HILBERT SPACE. Otton Martin Nikodým. [nd] 11p. (AECU-1361)

A study is made of discontinuous functionals in Hilbert space and the following theorem is proposed: If, in a Hilbert space (which may be neither separable nor complete), V is a linear subvariety in a linear space W and $f(x)$ is a linear functional defined on V, then there exists a stream-ordering R and a corresponding stream-sequence $\{f_\alpha(x)\}$ of linear continuous functionals in the Hilbert space such that $\lim_R f_\alpha(x) = f(x)$ whenever $x \epsilon v$ and $\{f_\alpha(x)\}$ does not tend to any limit if $x \bar{\epsilon} v$.

5296

[Kenyon Coll.]

A STUDY OF CONVEX SETS IN ABSTRACT LINEAR SPACES WHERE NO TOPOLOGY IS SUPPOSED; I. W. D. Berg and O. M. Nikodým. [nd] 12p. (AECU-1429)

This paper is primarily concerned with a study of the properties of the simplest convex sets, convex bodies, to the isolation of several useful notions; and to the disclosure of several paradoxes. The method is mainly geometrical, and the space generally is supposed to have infinite dimension.

5297

Los Alamos Scientific Lab.

PLANAR LINE FAMILIES II. Preston C. Hammer and Andrew Sobczyk. [nd] 18p. (AECU-1581)

The internal complexity of an outwardly simple family of lines in a plane has been considered. The turning points of an outwardly simple family are defined and their connection with certain derivatives shown. The area swept out in a bounded region by outwardly simple line families is defined, and it is shown that the set of all points evenly or infinitely covered by an outwardly simple line family is of measure zero.

5298

Los Alamos Scientific Lab.

THE INITIAL AND MIXED INITIAL AND BOUNDARY VALUE PROBLEM FOR HYPERBOLIC SYSTEMS. Peter D. Lax. Feb. 1, 1951. 21p. (LAMS-1205)

A finite difference scheme is presented for the numerical solution of initial and boundary value problems for first order nonlinear partial differential equations. Convergence and stability of the method is proved with mathematical rigor. (auth)

5299

Oak Ridge National Lab.

A RANGE CRITERION FOR TESTING AN OUTLYING OBSERVATION. Jack Moshman and George J. Atta. June 12, 1951. 12p. (ORNL-1020)

A method is suggested in the field of applied statistics by which information can be obtained for the solution of the problem of whether to reject an apparently anomalous reading in a series of measurements. The method does not depend on a sum of squares of the deviations but rather on the ratio of two ranges, or differences. The report includes a theoretical development of the method and a numerical example.

MEASURING INSTRUMENTS AND TECHNIQUES

5300

Los Alamos Scientific Lab.

THE USE OF THORIUM AS A THRESHOLD DETECTOR FOR FAST NEUTRONS. H. T. Richards. Aug. 23, 1943. Decl. June 6, 1951. 11p. (AECD-3178; LADC-908)

Counters have been built and tested in which Th fission is used as the detector of fast neutrons. At first a large background fission rate was observed when the chamber was irradiated by slow neutrons. This background was shown to be largely a photofission effect produced by γ rays which were emitted when the materials of and around the counter captured slow neutrons. Fe, Cu, and Cd appear to be the worst offenders. For a particular counter an 83-g Fe cyclinder placed around the counter multiplied the background by 5. A similar Cu cylinder raised the background by a factor of 3.3. With a suitable arrangement and choice of materials, it was possible to build a counter [illustrated] which had an efficiency of about 2×10^{-6} for fast neutrons (E > 1.2 Mev) yet gave a background fission rate of but 0.5 cpm when in a slow-neutron flux, nv ~ 10^7. (auth)

5301

Carbide and Carbon Chemical Div., UCC, K-25

ABSOLUTE BETA COUNTING OF RADIOACTIVE GASES USING END-WINDOW GEIGER-MULLER COUNTERS. F. D. Rosen, and W. Davis, Jr., Nov. 3, 1950. 31p. (AECD-3184; K-678)

A technique for absolute β counting of radioactive gases has been developed and applied to the determination of the vapor pressure of solid PF_5. From the vapor pressure data, as determined by counting, the heat of sublimation of PF_5 was found to be 6921 ± 159 cal/mole. Vapor pressure data determined by direct pressure measurement gave a value of 6855 ± 131 cal/mole. Calculations of absolute activity of the gas through the aid of the directly measured vapor pressure equation led to values that agreed with determinations on solid samples within 1.2%. (auth)

5302
Radiological Instrument Lab., Cleveland, Ohio
PORTABLE ALPHA METER MODEL 356; FINAL REPORT ON PROBLEM G-6 (Technical Report No. 5). D. E. Charpentier and J. B. Stickney. July 1, 1947. 78p. (AECU-1242)

A portable instrument similar to the "Zeuto," which is used for detection and rough measurement of alpha radiation, is described. The new instrument differs from the "Zeuto" principally in the mechanical design, which has been considerably improved. The circuit design remains relatively unchanged. The new instrument design maintains the characteristics of good linearity, fast response, and low meter drift, and at the same time greatly facilitates servicing and replacement of batteries and component parts. Performance tests are described in detail, and maintenance and operating instructions are appended. (auth)

5303
Argonne National Lab.
A ROTATING-SHUTTER TIME-OF-FLIGHT NEUTRON SPECTROMETER FOR THE RESONANCE REGION. Walter Selove. Apr. 1951. 46p. (AECU-1360; UAC-379)

A high-speed rotating-shutter spectrometer has been built for making slow-neutron measurements in the resonance region, using a neutron "pile" as a source. The design and operation of the apparatus are described. One of the principal advantages is that comparatively small samples are required—typically less than 1 g. Measurements are reported on Ag and W. These measurements were made with an effective resolution in reciprocal velocity somewhat better than 1.0 μsec/m at high energies. In Ag, the measurements show clearly resolved resonances at 5, 16, 30, 41, and 53 ev, and numerous unresolved resonances at higher energies. The constants of the 5 ev resonance are E_r = 5.17 ± 0.08 ev, σ_0 = 12,000 ± 1500 barns (10,000 barns for metallic Ag at room temperature), Γ = 0.17 ± 0.02 ev, Γ_n = 0.011 ev. The tungsten work includes measurements on separated-isotope samples of the four major isotopes. The resonance-level spacings observed in these isotopes are: 10 to 30 ev in 182, about 20 ev in 183, perhaps 100 ev in 184, and several hundred ev in 186. (auth) (See also AECU-520; NSA 3-1990.)

5304
Brookhaven National Lab.
SCINTILLATING LIQUIDS AS NEUTRON DETECTORS (L). C. E. Falk, H. Poss, and Luke C. L. Yuan. May 8, 1951. 7p. (AECU-1398)

The behavior of scintillating liquids (0.5% terphenyl-xylene and others showing similar responses) under neutron bombardment has been investigated. The liquids were tested in cylindrical glass cells cemented on magnetically shielded 5819 photomultipliers operated at 1000 v. The response of the terphenyl-xylene solution to neutrons and γ rays of various energies has been investigated, and the results are shown on graphs. The tests indicate that liquid scintillators as fast-neutron detectors have very high efficiencies and fairly good energy response so that energy biasing is possible. Their disproportional response to γ radiation makes them most useful in experimental arrangements where the γ-ray background is either very weak or consists of γ rays of low energy as compared to the neutron energy.

5305
Argonne National Lab.
TECHNIQUES IN THE CONSTRUCTION AND USE OF INTEGRATING IONIZATION CHAMBERS. William P. Jesse. May 1951. 50p. (AECU-1428; UAC-391)

Fundamental design of ionization chambers is discussed and a few characteristic designs for the actual construction are shown. Insulators for ion chambers and "stress currents" in insulators have been considered briefly. Limitations in the use of ionization chambers imposed by the fluctuation of the background are discussed. Techniques involved in the use of ion chambers to measure α, β, and γ radiation are discussed in some detail as well as the use of integrating ionization chambers for the measurement of slow neutrons. The design and use of the secondary electron emission chamber for measuring large dosages of γ radiation are mentioned briefly. Various pocket chambers for individual health protection are discussed. 31 references.

5306
Oregon State Coll.
A GAS-SAMPLE COUNTING METHOD FOR SOFT BETA EMITTERS. T. H. Norris. [nd] 9p. (AECU-1446)

A simple, rapid, and accurate gas-counting method for soft-beta emitters such as S^{35} and C^{14} is described. The method involves the use of a sample holder independent of the G-M counter. The holder has its own end window, adapted to fit in close proximity to a very thin end-window counter. The holder window itself can be very thin inasmuch as a pressure-equalizing system is used in introducing the gas sample.

5307
Washington Univ., St. Louis, School of Medicine
A METHOD FOR EMBEDDING SODIUM IODIDE CRYSTALS IN PLEXIGLAS FOR SCINTILLATION COUNTING. William B. Ittner III, and Michel Ter-Pogossian. [nd] 2p. (AECU-1506)

The report is reproduced here in its entirety.

Sodium iodide crystals activated by the addition of a small amount of thallium make very efficient gamma-ray detectors when used in conjunction with a photomultiplier tube in a scintillation counter (Hofstadter, Phys. Rev. 75, 796 (1949)). However, these crystals are highly hygroscopic and must be protected from air. This protection may be achieved by keeping the crystals coated with mineral oil or Canada balsam. A crystal thus protected is usually difficult to handle. Sodium iodide crystals may be used as grown in a quartz capsule filled with an inert gas (op. cit.). In this case, the crystalline mass is composed of a mosaic of small crystals and its efficiency for the detection of gamma rays is about 2.5 times lower than that of a single clear crystal (op. cit.).

It seems that a thin film of a transparent plastic would be an excellent protection for NaI(Tl) from the standpoint of easy handling and efficient light transmission. Several attempts were made in this laboratory to embed sodium iodide crystals in commercially made plastics of the polyester group. All these attempts proved unsuccessful because of the presence of various organic solvents in the resin which oxidized the iodine and discolored the crystals. The following successful technique was subsequently developed. The plastic used is powdered, polymerized acrylic resin. (Rohm and Haas, "Plexiglas"). Pressure and heat fuse this powder into a transparent block around the crystal. The success of this operation depends on the care taken to prevent any contact between the crystal and water or air during the operation, which may be achieved by taking the following precautions.

The powdered plexiglas is introduced into a vessel which was then evacuated by a mechanical vacuum pump. The vessel is then filled with helium or nitrogen to atmospheric pressure and sealed off. The plexiglas thus treated is reasonably free from air and water. The embedding is made in an iron mold shown in Fig. 1. The walls of the cylinder

should be able to withstand a pressure of 20,000 psi. The tolerance between the cylinder diameter and the piston should not exceed 0.0005 of an inch. The over-all dimensions of the mold depend upon the size of the plastic block desired. The mold, the vessel containing the plexiglas, and the crystal are introduced in a dry box filled with argon or any inert gas. A given amount of plastic is poured into the mold. The amount will be determined by the thickness of the plastic embedding desired. It should be noted that after compression and heating the volume of the plastic is reduced by a factor of 2. Then the crystal is removed from its container, (if it is kept in oil, it should be, of course, carefully wiped clean) and set on the plastic in the mold. Additional plastic is poured on top of the crystal to cover it. The piston is introduced into the cylinder. All the described operations are performed in the dry box in an inert atmosphere. All handling is done with the help of tongs or through rubber gloves. The mold is removed from the dry box and a pressure from 15,000 to 20,000 psi is applied while the mold is heated to 350° Fahrenheit. Both heat and pressure should be applied gradually. The compression is maintained for 3 hr. The sodium iodide crystal thus treated is perfectly wetted by the plexiglas and no interface can be observed between the crystal and the plastic. The plastic may be machined to a very thin coating which will minimize the losses of light by absorption in scintillation work.

5308

Arkansas Univ.

ARGON-TETRAMETHYLLEAD-METHANE PROPORTIONAL AND GEIGER COUNTERS. Paul E. Damon and Robert F. Overman. [nd] 4p. (AECU-1539)

The report is reproduced here in its entirety.

During the course of research on the measurement of the Pb^{210} β spectrum by proportional-counter spectrometry, the Pb^{310} was introduced into the counter as gaseous $Pb^{210}(CH_3)_4$. It was observed that for certain gas mixtures of lead tetramethyl, methane, and argon the threshold for Geiger action was exceptionally low, whereas for other mixtures the threshold was high, and the tube seemed to act quite well as a proportional tube.

Brass tubes were used during the experiment. The cathode diameters were 3.8 cm. The cathodes were thoroughly polished, cleaned, and outgassed by pumping, but were not baked or treated in any other way. The anode was of 4-mil tungsten wire. The length of the active volume was about 31 cm. The threshold for Geiger action of one of these tubes filled with 2.7 cm A was 1560 v. When 2-mm untagged $Pb(CH_3)_4$ was introduced into the tube, followed by 6.8 cm of argon, the threshold was instantaneously high, then lowered rapidly during a period of about 1 min to a low value of 560 v, after which it rose rapidly to a high equilibrium value. A similar effect was noticed for other combinations of argon and tetramethyllead.

A tube containing a mixture of 63.7 cm A and 9 mm $Pb(CH_3)_4$ showed a threshold increasing from 900 v 2 min after filling to 1570 v 1 hr after filling. When up to 10% methane was introduced, the threshold was stabilized at a low value, e.g., the threshold of a counter filled with 66 cm A, 6 cm CH_4, and about 1 mm $Pb(CH_3)_4$ was stable at 900 v. The plateau was 20% per 100 v without external quenching. When greater amounts of methane were added, the threshold rose rapidly to a high equilibrium value. One such tube filled to 72 cm pressure (28% CH_4 and 0.02% $Pb(CH_3)_4$) was found to operate satisfactorily as a proportional tube. The gas multiplication at 1960 v was about 400. The counter has been in use for about 2 months and has shown no appreciable change in its characteristics.

The usual explanation of such low threshold effects (Simpson, J. A., Rev. Sci. Instruments, 21, 6, 558-68(1950)); Wilkinson, D. H., "Ionization Chambers and Counters," pp. 45, 180, Cambridge University Press) is the quenching of the 11.5-ev metastable state of argon. That such an explanation is probably valid here is evident from the value for the ionization potential of $Pb(CH_3)_4$ given provisionally by Fraser and Jewett (Proc. Roy. Soc. (London) 160A, 563-74(1937)) as 11.5 ev. The stabilization reaction which takes place without methane or with methane in excess of 10% is, however, complex and cannot be explained satisfactorily by the authors.

The gas mixture with less than 10% methane shows promise as a filling for low-voltage high-pressure cosmic-ray counters with large dimensions.

5309

Argonne National Lab.

DOUBLE DELAY LINE PULSE SHAPING. T. B. Novey and D. W. Engelkemeir. July 1951. 4p. (AECU-1553; UAC-415)

NaI(Tl) crystals are very useful in the study of soft γ radiation by scintillation measurements but, because of the relatively slow decay time (~ 0.25 μ sec) as compared to the organic phosphors, the pulses are not suitable for fast coincidence counting. A procedure is given for the study of soft γ radiation which makes use of a double-delay-line shaping of the pulses from the crystals in order to obtain 0.08 μ sec full width at half height. Double-delay-line shaping of the NaI(Tl) pulse, and the shaping circuit are illustrated.

5310

Argonne National Lab.

SPECIAL METHODS FOR I.B.M. COMPUTATIONS. D. A. Flanders, G. W. Evans II, E. L. Dershem, J. L. Sukup, and J. H. Alexander. June 1951. 33p. (ANL-4640)

A group of notes are presented showing various wiring diagrams for and methods of computing on the 417 or 402 (Accounting Machine), the 604 (Electronic Calculating Punch), and the C.P.C. (Card Programmed Electronic Calculator).

5311

Oak Ridge National Lab.

A PROPORTIONAL COUNTER METHOD BY MEASURING THE FAST NEUTRON DOSE. G. S. Hurst. Apr. 27, 1951. 7p. (CF-51-4-122)

It is shown how an ionization-chamber method developed by L. H. Gray (Proc. Cambridge Phil. Soc. 40, 72(1944)) can be applied to a proportional counter and used to measure the rep dose due to fast neutrons in the presence of high intensities of γ or x radiation. A methane-filled chamber lined with a methane equivalent, e.g., paraffin, serves as a satisfactory dosimeter for fast neutrons. The associated electronic circuit must bias out γ pulses and integrate recoil-proton pulses from neutron collisions according to pulse height. Diagrams illustrate the experimental apparatus used to check the response with monoenergetic beams of fast neutrons. A pulse integrator that measures the energy of the spectrum in one operation has been designed for use with a counter of the nondirectional type. A graph shows the relative counts per neutron per cm^2 as a function of integral pulse-height setting for 6 neutron energies between 365 kev and 2.5 Mev, and another gives relative dose per neutron per square centimeter vs. neutron energy.

5312

Ames Lab.

OPTICAL PROPERTIES OF COUNTING DIAMONDS. R. K. Willardson and G. C. Danielson. July 13, 1951. 31p. (ISC-150)

Optical properties of 32 γ-counting diamonds have been investigated. These properties include the ultraviolet transmission limit, the infrared absorption spectra, the birefringence, and the luminescence. The approximate percentage of Type I and Type II, estimated by both the ultraviolet and infrared absorption criteria, and the relative counting efficiency of each diamond are shown together on a single chart. One concludes that good γ-counting diamonds usually have substantial portions that are Type II but diamonds entirely Type II are not necessarily good counters. In addition to the well known absorption maximum at a wavelength of 8 μ, Type I diamonds appear to exhibit an absorption maximum at a wavelength of 21 μ. Experimental evidence is given for the existence of normally empty trapping levels 0.5 and 0.7 ev below the conduction band and for the existence of point contact rectification in diamond. (auth) 22 references.

5313

Los Alamos Scientific Lab.

THIN WINDOW PROPORTIONAL BETA CHAMBER. John H. Larkins. May 2, 1951. 8p. (LA-1238)

A description and diagrams are given of a thin-window proportional β chamber with the following purpose of design: to eliminate leakage of gas by use of gaskets and positive seals rather than grease; to provide easier means of changing wires and cleaning chambers; to minimize inside volume in order to reduce natural background; to provide for reproducibility of counting characteristics (within < 0.5%) by maintaining close tolerances on important dimensions; and to provide for easier flushing by eliminating air traps and dead spots within the chamber. Ten chambers have been in use at Los Alamos for more than 6 months. The only trouble encountered has been with an accumulation of a varnish-like material (apparently from the gas used) which began to cause changes in their counting characteristics after about 5 months. This condition was remedied by replacing the wires, and in all cases the chambers resumed their original characteristics.

5314

Los Alamos Scientific Lab.

MODEL PA-2 PULSE AMPLIFIER. Verner G. Rexroth. May 4, 1951. 18p. (LA-1239)

Diagrams, description, and photographs of the model PA-2 pulse amplifier are given. It is designed primarily for use with a β proportional counting system but with slight modifications may be adapted to many other counter-amplifier applications such as α proportional and scintillation counting. Contained in the instrument is a negative input pulse amplifier, a pulse equalizer with a negative output signal of approximately 1 v that will operate most of the available scalers, and a chamber voltage supply capable of supplying from 0 to 5000 v which is sufficient for most proportional counter applications. The over-all resolving time of the instrument as measured with a double pulser is somewhat less than 5 μsec, making it possible to count at rates as high as 100,000 cpm with less than 1% conicidence loss.

5315

Los Alamos Scientific Lab.

PERSONNEL PROTECTION GAMMA RADIATION METER. Richard J. Watts. July 11, 1951. 11p. (LA-1274)

A simple instrument in which the small currents available from an ionization chamber are used to develop a voltage across a high resistance is described for the detection and rough measurement of γ radiation in the range 0.05 to 100 r/hr. Features of the instrument are the least possible number of components, ease of battery replacement, and complete waterproofing obtained by the use of a lucite faceplate.

5316

Los Alamos Scientific Lab.

THE RESPONSE OF SENSITIVE 552 DUPONT FILM TO BETA RADIATION. Ellery Storm. Aug. 13, 1951. 26p. (LA-1284)

The response to β radiation of sensitive 552 DuPont film, enclosed in the usual manufacturer's packet, was measured in terms of rep. β-emitting isotopes Ca^{45}, W^{185}, Tl^{204}, Bi^{210}, P^{32}, Pa^{234}, and K^{42} covering a maximum-energy range from 0.26 to 3.50 Mev were used. The exposures were measured in rep by means of an air ionization extrapolation chamber. The film response was found to diminish sharply below 0.8 Mev, and became nearly energy independent beyond 2.5 Mev. A method is described for determining both the energy and the exposure of a film exposed to β and γ radiation by means of four filters on the film. (auth)

5317

Oak Ridge National Lab.

A THIMBLE TYPE GAMMA-RAY DOSIMETER AND THE MEASUREMENT OF THE RADIATION FROM LUMPED AND DISTRIBUTED TYPE SOURCES. Edgar B. Darden, Jr., and C. W. Sheppard. July 9, 1951. 58p. (ORNL-1002)

Small thimble ionization chambers have been developed to serve as standard as well as practical γ-ray dosimeters. By means of the Bragg-Gray cavity principle the electromagnetic energy absorbed in the walls and dissipated as ionization in the gas inside the chamber may be quantitatively related to the energy adsorbed in surrounding tissue or tissue-like material. The intensity of the dose in r/sec may be calculated from a knowledge of the ion current and the volume of the cavity with suitable corrections for attenuation and other wall effects. A thimble chamber of this type is described in some detail beginning with a brief review of the underlying physical principles and an exploded-view drawing of the chamber assembly is appended. A brief discussion is included of the principal factors affecting the practical performance of the chamber in collecting ions. The report is concluded with a résumé of the work that has been carried out in the Biology Division of ORNL with γ-ray thimble chambers including calibration tests, Sievert dose determinations, experiments on the effect of backscatter, and the use of the chamber for determining the intensities of dose given to biological material exposed to external sources, and also certain distributed type sources of γ radiation.

5318

Oak Ridge National Lab.

QUARTERLY PROGRESS REPORT FOR PERIOD ENDING APRIL 20, 1951; HEALTH PHYSICS DIVISION. K. Z. Morgan. May 31, 1951. 19p. (ORNL-1004)

Results are discussed briefly of an investigation of the responses of pocket chambers of various dimensions and materials (polyethylene, C, and Al) using Po-Be and Po-B neutron sources. A technique for the measurement of particles down to 0.006μ in diameter has been investigated with good preliminary results. The uniform-response neutron counter, mentioned in ONRL-695, has been calibrated with the Po-Be and the Po-B neutron sources. The counter has an equal sensitivity of $(1.75 \pm 0.10) \times 10^{-3}$ counts/neutron/cm^2 for the two sources. Calculations have been made of the contribution of neutrons scattered in air to the total dose at different distances from a spherically symmetric shield assuming constant cross sections, isotropic scattering, and no absorption in the air. The calculations were made by evaluating the exact solution of the Boltzmann equation for this case. A production design of a constant water monitor has been completed and is discussed briefly. Brief statements are made concerning the status of various other projects of the ORNL Health Physics Division.

5319
Oak Ridge National Lab.
A STANDARD GAMMA RAY IONIZATION CHAMBER FOR SHIELDING MEASURMENTS. L. H. Ballweg and J. L. Meem. July 9, 1951. 55p. (ORNL-1028)

A series of four ionization chambers for measuring γ-ray dosage has been constructed for use at the Bulk Shielding Facility for shielding measurements. A 50-cc chamber having a grid resistance of 10^{12} ohms was designed to be as near as practical a point chamber and was chosen to be the standard ion chamber against which three other ion chambers (900 cc 10^{12} ohms, 900 cc 10^{10} ohms, and 500 cc with a variable resistance of 10^{9} to 10^{10} ohms) could be standardized. The air calibration of the standard chamber and the subsequent standardization of the remaining chambers are described. The standard chamber was first calibrated against a Ra source using air at atmospheric pressure in the measuring volume of the chamber. It was necessary to later replace the air in the chambers with CO_2 to eliminate the possibility of the (n,p) reaction of N producing secondary ionization within the chamber during shielding experiments. Several experiments were run with air and CO_2 to determine the factor necessary to correct the readings taken with CO_2.

5320
Atomic Energy Project, Univ. of Calif., Los Angeles
AN AUTOMATIC LOW-RATE ALPHA COUNTER FOR USE WITH CONTINUOUS DUST RECORDERS. Leonard Baurmash and Jacob E. Dietrich. June 4, 1951. 12p. (UCLA-139)

An automatic alpha counter utilizing a ZnS(Ag) screen and an RCA 1P21 photomultiplier was designed and built for use in counting continuous dust recordings. It has an instrument background of 0.107 cts/hr. The optical system yielded a geometry of 22.5 ± 0.3% in counting samples. The instrument can be converted for counting biological and soil samples. During this type of operation, the counter has a background of 0.39 cts/hr. (auth)

5321
A DEVICE FOR THE PROMPT DETECTION OF RADIOACTIVE AEROSOLS. (abstract) C. T. Rainey. [nd] 1p. (UCRL-1347)

The report is reproduced here in its entirety.

A device for the prompt detection of radioactive aerosols is described. It consists of two detectors—one measuring the activity of suspect air, the other measuring air known to contain no activity other than that due to naturally occurring airborne radioisotopes. The difference between the two channels is recorded as a measure of contamination. Alpha emitters were used in the investigation but the equipment may be converted to measure beta. The fact that contamination may be expected to occur in bursts makes possible the detection of levels below the average concentration considered permissible. The equipment lends itself to the investigation of probable sources of contamination in laboratory procedures.

5322
Radiation Lab., Univ. of Calif.
INVESTIGATIONS WITH A DEVICE FOR THE PROMPT DETECTION OF RADIOACTIVE AEROSOLS. C. T. Rainey. June 8, 1951. 21p. (UCRL-1391)

An abstract of this report was issued as UCRL-1347 and appears in its entirety in the preceding abstract.

5323
Oak Ridge National Lab., Y-12 Area
A FLOW-TYPE IONIZATION CHAMBER FOR MEASUREMENT OF ACTIVITY IN LOW-ENERGY BETA EMITTING GASES. R. L. Quinn. Aug. 1, 1951. 12p. (Y-791)

A method is presented for the measurement of activity in low-energy β-ray-emitting gases under conditions of flow over a wide range of activities. The design of the flow-type ion chamber is described. The activity of $S^{35}O_2$ gas was measured over a range of 10^{-10} to 10^{-1} c/liter. The activity of a gas stream flowing at 32 liters/min can be continuously monitored with this instrument.

5324
Oak Ridge National Lab., Y-12 Area
CALIBRATION OF A FLOW-TYPE IONIZATION CHAMBER WITH RADIOACTIVE SULFUR DIOXIDE. J. W. Thomas and R. L. Quinn. Aug. 20, 1951. 25p. (Y-793)

An ionization chamber equipped with a vibrating reed electrometer and recorder has been calibrated for continuously measuring radioactive SO_2 in a flowing gas stream. The calibration was made by counting gas samples after conversion to $BaS^{35}O_4$. A calibration factor of 0.64×10^{-11} amp of ion current/μc/liter of $S^{35}O_2$ was established. The detectable limit was calculated to be 1.5×10^{-4} μc/liter. Using a collecting potential of 2000 v, activities up to at least 3 mc/liter may be measured. At high voltages, the ion current is proportional to the gas activity, and there is no difference in the ion current with or without a flow of 32 liter/min through the chamber. (auth)

5325
Commissariat à l' Énergie Atomique
DETECTION OF α PARTICLES WITH THE AID OF A FLUORESCENCE COUNTER. (In French) Y. Koechlin. July 1951. 35p. (CEA-86)

Experiments with scintillation counters, used as detectors of α rays, comprised both counts of pulses corresponding to single particles, and measurements of mean currents due to the integration of pulses. The detectors used were thin plates of anthracene and ZnS-Ag deposits. A ready discrimination could be made between individual pulses produced in simultaneous bombardments with α particles of Po, and β and γ rays of Ra. Po sources of 0.001 μc were detected with the aid of a galvanometer and a ZnS-Ag preparation. Quantic efficiencies (ratio between the number of pulses and the number of α particles traversing the counter) of the order of 100% were observed, by comparing with the efficiency of a thin-walled Geiger counter. Anthracene counters permitted determinations of the energy of impinging α particles with a 2% error.

5326
Atomic Energy Research Establishment, Harwell, Berks (England)
ALPHA ASSAY EQUIPMENT TYPE 1093A; INTERIM MANUAL. [nd] 22p. (NP-3067)

A specifications and operations manual is given for the Alpha Assay Equipment, type 1093A. The equipment is suitable for the measurement of activities of less than 100 disintegrations/min. A discussion of the operation and maintenance of each integral unit is given.

5327
Army Chemical Center, Md.
THE UCLA DOSIMETER, ITS RECENT MODIFICATIONS AND ADDITIONAL APPLICATIONS, paper 9 of REPORT OF SYMPOSIUM IV; CHEMISTRY AND PHYSICS OF RADIATION DOSIMETRY [HELD AT THE] ARMY CHEMICAL CENTER 18, 19, and 20 SEPTEMBER 1950; PART I—UNCLASSIFIED PAPERS. George V. Taplin, Clayton Douglas, and Butler Sanchez. [nd] 20p. (NP-3237(paper 9))

An investigation has been conducted to develop a simple colorimetric method of measuring high-energy γ radiation over a wide dosage range. A two-phase system consisting of alcohol-free chloroform, overlayered with aqueous brom cresol purple, may be adjusted to measure x or γ irradiation

throughout a wide range of doses (1.0 to 1000 r or higher). The end point of the color reaction is sharp and doses of radiation may be estimated within a 10 to 15% range of error. With suitable instrumentation, the chemical system may be shielded against light and against soft γ radiation and thereby record accumulated doses of high-energy γ radiation, relatively independent of wavelength. These characteristics provide a basic method of radiation measurement which is adaptable to the manufacture of three important radiation monitoring devices, namely, (1) a personnel casualty badge (200, 400, 800 r), (2) an area monitoring device (100 to 1000 r or higher), (3) an emergency personnel monitoring dosimeter (10 to 100 r). (See also UCLA-58; NSA 4-2389)

5328

ON THE FLUORESCENCE AND PHOSPHORESCENCE OF ALKALI-EARTH PHOSPHORS CONTAINING Ce AS AN ACTIVATOR. L. I. Anikina. Zhur. Eksptl'. i Teoret. Fiz. 21, 310-13(1951) Feb. (In Russian)

It is shown that when an alkali-earth phosphor is excited in the absorption band that is due to the activator Ce ($\lambda \sim 438$ mμ), a fluorescence of the Ce light centers takes place, whose mean lifetime is (1 to 2) $\times 10^{-8}$ sec. This is accompanied by a thermal dissociation (ionization) of a small number of excited centers, giving rise to a protracted afterglow phosphorescence. (auth)

5329

NUCLEAR PARTICLE AND RADIATION DETECTORS. PART II. COUNTERS AND COUNTING SYSTEMS. J. Sharpe and D. Taylor. Proc. Inst. Elect. Engrs. 98(II), 209-30(1951) Apr.

This is a continuation of a companion paper entitled "Nuclear Particle and Radiation Detectors: Part 1—Ion Chambers and Ion-chamber Instruments," and it discusses counters and counting systems. Again the emphasis is on the detectors (i.e., the counters in this case), but some details are given of the auxiliary equipment required for a counting system, namely, amplifiers, counting-rate meters, scalers, and registers, and examples of a number of complete instruments are also given.

Proportional, Geiger-Mueller and scintillation counters are considered in detail, while crystal counters, secondary-emission particle detectors and thermal detectors receive only brief mention. As was the case in Part 1, the aim has been to provide sound theoretical and practical descriptions of those instruments which—in the opinion of the authors—are likely to find wide application in nuclear engineering. Illustrations of instruments and components are given, and applications are drawn wherever possible from present practice at the Atomic Energy Research Establishment. (auth)

5330

ON POST-EMANATION RADIOACTIVITY. Umberto Sborgi. Chimica, e Industria (Milan) 33, 218-20(1951) Apr. (In Italian)

The quantity of Pb^{210} produced by Rn in various materials, e.g., in mineral waters, is conveniently determined by coprecipitating Pb^{210} as a sulfate with ordinary Pb and Bi and measuring the activity with the aid of a Geiger counter.

5331

PRACTICAL ASPECTS OF RADIOACTIVITY INSTRUMENTS. II. TESTING AND SERVICING. W. J. Ladniak. Nucleonics 8, No. 6, S13-19(1951) June.

Some of the equipment needed and techniques used to test and service instruments are discussed. Some specific items which should be checked in testing are mentioned. Data sheets used in testing certain instruments at ORNL are shown, and a thorough procedure to be used in testing a Higinbotham scaler is outlined. Tables of procedure for servicing monitoring and survey instruments are outlined to serve as a guide in setting up procedures for other instruments. The means of contact used at ORNL for correlation of the findings of design engineer, instrument mechanic, and testing and servicing divisions are described.

5332

THE SCINTILLATION COUNTER IN CLINICAL STUDIES OF HUMAN THYROID PHYSIOLOGY USING I^{131}. Herbert C. Allen, Jr., Raymond L. Libby, and Benedict Cassen. J. Clin. Endocrinol. 11, 492-511(1951) May.

Reliable thyroid-uptake studies using doses as small as from 1 to 10 μc of I^{131} are now possible in the human being, using the wide-angle scintillation counter. Precise outlining of the thyroid gland or other areas of radioactivity is now possible. A simple technic for delineation of the gland is described. A description of the two types of scintillation counters is given: a directional scintillation counter 27 times more sensitive, and a wide-angle scintillation counter 94 times more sensitive, than the conventional end-window G-M tube. The application of these two scintillation counters to other types of clinical radiotracer studies is discussed. (auth)

MESONS

5333

Rochester Univ.

DISINTEGRATION OF THE DEUTERON BY π^+ MESONS AND THE SPIN OF THE π^+ MESON. Donald L. Clark, Arthur Roberts, and Richard Wilson. July 1951. 31p. (NYO-901)

The total cross section for the reaction $\pi^+ + d \rightarrow p + p$ has been measured for an average incident meson energy of 23 Mev. This corresponds to a proton energy of 340 Mev in the inverse reaction $p + p \rightarrow \pi^+ + d$, for which the total cross section has been measured by others. Comparison of these two cross sections, using the theorem of detailed balancing, leads to a determination of the statistical weight, and hence the spin, of the π^+ meson. The spin turns out to be 0.

5334

California Univ.

THE ENERGY SPECTRUM OF THE POSITRONS FROM MU-MESONS DECAY. (dissertation) William L. Gardner, Jr. May 1951. 43p. (UCRL-1261)

An investigation of the energy of the electrons resulting from the decay of μ mesons has been conducted using a relatively new technique. Mesons produced artificially by protons from the 184-in. cyclotron were used as the source of positrons, and the energies of these positrons were measured in a spiral orbit spectrometer. The apparatus and experimental procedure are illustrated and described in detail. A graph of observed intensity vs. momentum is compared with theory, assuming various forms of coupling. The momentum value for the intensity maximum is $p = 74 \pm 3\ m_e c$. The momentum maximum is $p = 110 \pm 5\ m_e c$. For a μ-decay scheme of $\mu^+ \rightarrow e^+ + 2\nu$, and assuming the neutrino mass $\cong 0$, the μ-meson mass corresponding to this momentum maximum is $220 \pm 8\ m_e$.

5335

Radiation Lab., Univ. of Calif.

THE ENERGY SPECTRUM OF THE POSITRONS FROM μ^+ MESON DECAY. Ryokichi Sagane, William L. Gardner, and Harmon W. Hubbard. June 15, 1951. 31p. (UCRL-1261(rev.))

The energies of the positrons from μ^+ meson decay have been measured in a spiral-orbit spectrometer. The mesons were produced by the 340-Mev protons from the Berkeley 184-in. cyclotron. The spectrometer employed a particle orbit of 21-in. diam with magnetic fields as high as 20,000 gauss. The positrons were detected by scintillation crystals in quadruple coincidence. The curves resulting from 3 theoretical interactions, tensor antisymmetric with charge

exchange, scalar with charge retention, and pseudoscalar with charge retention are identical with or in good agreement with the observed spectrum.

5336

Radiation Lab., Univ. of Calif.

PRODUCTION OF π^+-MESONS BY 340-MEV PROTONS ON PROTONS AT 0° TO THE BEAM. (thesis) W. F. Cartwright. Apr. 16, 1951. 67p. (UCRL-1278)

Report is made of a detailed investigation of the $p + p - \pi^+$ cross section as a function of energy in the forward direction. The meson production from both polyethylene and carbon was measured and the proton-proton meson-production spectrum obtained by subtraction. The method of Richman and Wilcox (Phys. Rev. 78, 496(1950)) for measurement of production of mesons at 90° by protons interacting with C was adapted to 0° measurements by the addition of a magnetic field which causes the mesons to circle away from the proton beam. All the experiments were done in the external beam of the Berkeley synchro-cyclotron. The method is explained in detail, and results are tabulated and plotted. Two possible reactions can occur, namely, $p + p \rightarrow \pi^+ + n + p$ and $p + p - \pi^+ + d$. It is concluded that the peak in the spectrum at 70.6-Mev meson energy is due solely to deuteron formation, the deuteron binding energy being made available to the meson. The meson mass was determined to be $275.1 \pm 2.5\ m_e$.

5337

Radiation Lab., Univ. of Calif.

THE PRODUCTION OF PHOTOMESONS FROM HELIUM. (thesis) Mark J. Jakobson. May 25, 1951. 76p. (UCRL-1317)

A study has been made of the mesons produced from He by the bombardment of a high pressure target with the 312 ± 15 Mev bremsstrahlung beam of the Berkeley synchrotron. Measurements were made at angles of 45, 90, and 135° to the beam direction with scintillation-counter detectors at 90 and 135°, using $\pi^+ - \mu^+$, $\pi^+ - \beta^+$, and $\pi^+ - \mu^+ - \beta^+$ delayed-coincidence techniques, and with Ilford C-2 emulsions at 45°. The minimum energy detected was about 35 Mev, due principally to the energy loss of the mesons in the target walls. Bombardments were also carried out on H giving H/He ratios. The energy spectra of π^+ mesons from H and from He have been obtained for the three angles, as well as the π^- energy spectrum for He at 45°. The ratio of π^- to π^+ mesons from helium at 45° is 0.99 ± 0.15. Differential and total cross sections for π^+ production were evaluated, extrapolating from the minimum energy detected to zero meson energy. 47 references. (auth)

5338

Radiation Lab., Univ. of Calif.

PHOTOMESONS FROM DEUTERIUM. (thesis) Robert Stephen White. May 24, 1951. 72p. (UCRL-1319)

Photons of maximum energy 312 ± 15 Mev in the "spread-out" bremsstrahlung beam of the Berkeley electron synchroton have been used to produce charged mesons from D_2 and H_2. The gas was bombarded in a high-pressure, low-temperature target at a pressure of 140 atm and a temperature of 77°K. The π mesons that were produced were collimated at 45, 90, and 135° to the photon beam direction. π^+ mesons were detected by scintillation crystals using π-μ, π-β, and π-μ-β coincidence detection. π^+ and π^- mesons were detected with nuclear emulsions. The ratio of the number of π^- to π^+ mesons produced from deuterium is plotted as a function of the meson energy at an angle of emission of 45°. The mean values of the minus-plus ratio at 45 and 90° are 0.96 ± 0.11 and 0.98 ± 0.14, respectively. Ratios of the differential cross sections for π^+ mesons from D_2 and H_2 are given. Total cross sections for π^+-meson production from D_2 and H_2 have been obtained, and the ratio of the total cross sections is given.

5339

Radiation Lab., Univ. of Calif.

PRODUCTION RATIO OF PHOTOMESONS FROM BERYLLIUM. Heinrich A. Medicus. June 8, 1951. 3p. (UCRL-1346)

By the irradiation of targets with a high-energy x-ray beam, both negative and positive π mesons are produced. An investigation was made to determine the ratio of the numbers of mesons of either sign produced in $_4Be^9$ because its single isotope Be^9 has one neutron with only 1.6-Mev binding energy. Only mesons emitted at an angle of 90° ± 7° to the x-ray beam and in the energy range 30 to 70 Mev were investigated in this experiment. The ratio of negative to positive mesons depends little, if any, on the energy in the investigated range. The over-all ratio for mesons of 30 to 70 Mev is 2.2. This high minus-plus ratio cannot be explained merely by the fact that the Be nucleus has one more neutron than protons. Rather it seems as if this one neutron of the low binding energy would act as a free particle, and therefore would have a higher production cross section. This is analogous to the case of the production of positive mesons, where free protons have a higher production cross section for π^+ mesons than bound ones. In light elements in which no particle has such a preferred position, as in D_2, He, and C, the respective minus-plus ratios are 1.0.

5340

Radiation Lab., Univ. of Calif.

THE INTERACTION OF π MESONS WITH NUCLEAR MATTER. K. A. Brueckner, R. Serber, and K. M. Watson. June 20, 1951. 36p. (UCRL-1358)

A number of experiments relating more or less directly to meson scattering and absorption are discussed and compared. Because of the variety of experiments interrelated by such considerations, it is seen that any model to describe meson scattering and absorption will have to meet a corresponding number of conditions. In particular, the absorption experiments of Panofsky and his collaborators permit one to put a lower limit on the absorption cross section for complex nuclei which seems appreciably larger than the expected scattering cross section. (auth)

MICROWAVES

5341

THE MICROWAVE SPECTRA AND MOLECULAR STRUCTURES OF TRIFLUOROSILANE DERIVATIVES. John Sheridan and Walter Gordy. J. Chem. Phys. 19, 965-70 (1951) July.

Pure rotational spectra have been measured for the molecules $Si^{28}F_3H$, $Si^{29}F_3H$, $Si^{30}F_3H$, $Si^{28}F_3Cl^{35}$, $Si^{28}F_3Cl^{37}$, $Si^{28}F_3Br^{79}$, $Si^{28}F_3Br^{81}$, and $Si^{28}F_3CH_3$. Values of B_0 and moments of inertia, I_B, are tabulated. The nuclear quadrupole couplings of Cl^{35}, Br^{79}, and Br^{81} in these molecules have been determined from their hyperfine structures as −43, 440, and 370 Mc/sec, respectively. Molecular dimensions, calculated by assuming the first parameter mentioned to be within the stated limits, are, for SiF_3H, $d_{SiH} = 1.55 \pm 0.05$ A, $d_{SiF} = 1.561 \mp 0.005$ A, $\angle FSiF = 108°6' \mp 30'$; for SiF_3Cl, $\angle FSiF = 108°30' \pm 1°$, $d_{SiF} = 1.560 \mp 0.005$ A, $d_{SiCl} = 1.989 \pm 0.018$ A; for SiF_3Br, $\angle FSiF = 108°30' \pm 1°$, $d_{SiF} = 1.560 \mp 0.005$ A, $d_{SiBr} = 2.153 \pm 0.018$ A. The special shortness of silicon-halogen bonds is discussed and shown to be related to the electronic structure of silicon. The spectrum of SiF_3CH_3 shows lines caused by molecules in excited torsional-vibrational states, which show additional splitting caused by the doubling of the torsional vibrational levels. From relative intensities the height of the barrier

opposing free rotation about the SiC bond is estimated as 1200 cal/mole. From the variations of B_0 with torsional vibration, the separations of the doublets in the ground, first, and second torsional-vibration levels are estimated as 0.1 cm^{-1}, 1.4 cm^{-1}, and 12 cm^{-1}, respectively. (auth)

NEUTRONS

5342

Los Alamos Scientific Lab.

THE FISSION NEUTRON SPECTRUM OF 25. H. T. Richards. Feb. 11, 1944. Decl. June 6, 1951. 20p. (AECD-3177; LADC-909)

Photographic plates have been used to measure the energy of neutrons from the fission of U^{235}. The spectrum, as inferred from the ranges of 850 protons recoiling in the forward direction, shows a very wide maximum at ~1.5 Mev with an exponentially decreasing high-energy tail which extends beyond 7 Mev. The minimum energy neutrons recorded were ~700 kv. If the spectrum is extrapolated to zero, one finds that the average neutron energy is about 1.85 Mev. The stopping power of the plates was calibrated by the use of monochromatic neutrons from the $Li^7(p,n)Be^7$ reaction and the d-d reaction. (auth)

5343

Brookhaven National Lab.

GRAVITATIONAL ACCELERATION OF NEUTRONS. A. W. McReynolds. [nd] 6p. (AECU-1408)

Gravitational acceleration of neutrons has been determined by measurement of the drop of a highly collimated beam of thermal neutrons from the Brookhaven reactor in 12 m of path or, more specifically, the difference in drop of neutrons of different velocity but defined by the same collimating system. A typical plot of the two beams, adjusted to the same peak height, shows a downward shift of the slower neutron beam of about 1.2 mm in 12-m path. The calculation of g for neutrons is outlined, the result obtained being $g = 935 \pm 70$ cm/sec^2.

5344

Knolls Atomic Power Lab.

THE COMPLETE SOLUTION OF THE ONE-VELOCITY DIFFUSION PROBLEM AT INTERMEDIATE AND LARGE DISTANCES. Lewi Tonks. [nd] 17p. (AECU-1565)

An approximate evaluation of the branch-cut integral which occurs in the rigorous solution of the Boltzmann equation for the one velocity neutron diffusion problem at intermediate and large distances leads to

$$\underline{\varphi(r)} \simeq \frac{\sigma}{2\pi r}\left[\frac{\nu^2(1-\nu^2)}{g(\nu^2-f)}\,e^{-r\sigma\nu} + \frac{2[1-y_0/(\pi^2+y_0^2)]}{g^2(\rho-2)(\pi^2+y_0^2)}\,e^{-r\sigma}\right]$$

for the point source and

$$N(Z) \simeq \frac{\nu^2(1-\nu^2)}{g(\nu^2-f)}\,e^{-Z\sigma\nu} + \frac{2[1-v_0/(\pi^2+v_0^2)]}{g^2(\rho-1)(\pi^2+v_0^2)}\,e^{-Z\sigma}$$

for the plane source. The equation for the point source is actually 23% high for zero absorption ($f = 0$) and $r\sigma = 7$, but the error decreases with increasing $r\sigma$ and f. It is seen that the branch-cut term is not simply the contribution of non-collided neutrons. A plot is shown of the region in the $f - r\sigma$ plane where the two terms are comparable. (auth)

5345

Hanford Works

SHIELDS FOR NEUTRON SOURCES. Frank R. Jones. May 1, 1950. 12p. (HW-21169)

The attenuation of fast neutrons from Po-Be and Po-B sources in cylindrical shields of water and paraffin has been measured. The intensity of the associated slow neutrons has been measured. These data are presented in the form of curves which will be helpful in designing similar containers. There is no measurable difference in the behavior of the neutrons from the two sources. Water is slightly less effective than paraffin in reducing the fast neutron flux. For temporary shields water may be convenient but for permanent ones the danger of a leak going undetected until someone had received an overexposure leads to the conclusion that paraffin is to be preferred. (auth)

5346

Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.

NUCLEAR SHIELDING STUDIES; XI. FAST NEUTRON SPECTRA MEASURED BY THE PHOTOGRAPHIC PLATE METHOD. (Technical Report No. 47) P. H. Stelson. Oct. 12, 1950. 68p. (NP-1999)

Several experiments in which the photographic plate method was used to measure fast neutron spectra are described. The Rockefeller electrostatic generator was used as a source of monoergic protons and deuterons. Two introductory experiments on the range of ThC′ (Po^{212}) α particles in the emulsion and the shrinkage factor due to processing and on the neutron spectrum of a Po-Be source are described. The $F^{19}(d,n)Ne^{20}$ and the $H^2(d,n)He^3$ reactions were studied to gain information about the stopping power of NTB emulsions, the neutron background, and the resolving power of the photographic plate method. The $Li^7(p,n)Be^7$ spectrum was measured to calibrate the range-energy relation at low neutron energies and to study the resolution in this energy region. The $V^{51}(p,n)Cr^{51}$ reaction was measured at proton energies of 3.23 and 3.72 Mev. Excited states with intensities comparable to the ground state were found at 775, 1165, 1420, and 1530 kev. The values of the relative intensities of these excited states are given. This investigation indicates that the V(p,n) reaction is monoergic up to $E_n = 775 \pm 50$ kev. The spectra resulting from inelastic scattering of 15-Mev monoergic neutrons from Pb, Fe, and Al were measured. The resulting spectra are Maxwellian, as predicted by the Weisskopf statistical theory, but the nuclear temperatures of 0.7, 0.6, and 1.1 Mev obtained for Pb, Fe, and Al, respectively, are lower than the theory predicts. The high energy of the incident neutrons suggests that the (n,2n′) process is the principal mode of decay, and the consequences of this are discussed.

NUCLEAR PHYSICS

5347

Columbia Univ.

NUCLEAR PHYSICS RESEARCH AT COLUMBIA UNIVERSITY. John R. Dunning, Director. Mar. 15, 1950. 43p. (DR-1378)

5348

Yale Univ.

INTRODUCTION TO NUCLEAR PHYSICS, paper 3 of HEALTH PHYSICS INSURANCE SEMINAR; [FEBRUARY 6–10, 1950]. Ernest Pollard. Mar. 12, 1951. 4p. (TID-388 (paper 3))

A very brief, elementary description in popular terms of nuclear structure and the nature of various radiations is presented.

5349

Mass. Inst. of Tech.

QUARTERLY PROGRESS REPORT; APRIL-JUNE 1950; NEUTRON AND GAMMA RAY SHIELDING GROUP AND ELECTRONIC NUCLEAR INSTRUMENTATION GROUP. July 1, 1950. 35p. (NP-3043)

Graphical results of scattering-in experiments on Pb show two probable neutron energy levels at 0.7 and 1.7 Mev when measured with a propane counter. The response of a small

$B^{10}F_3$ counter to monoenergetic neutrons (shown graphically) contains three resonances at ~1.3, ~1.6, and ~2.0 Mev because of charged particle reactions in B^{10} or F^{19}. Results are shown of the measurement of the $Li^7(p,n)Be^7$ reaction for the energy regions 3.68, 3.23, 2.78, and 2.33 Mev. The excitation of the 7.2-sec isomeric state of Au^{197} by inelastic scattering of neutrons has been investigated. The threshold for this reaction has been found at approximately 520 kev with an additional observed level at 1.22 Mev and an indicated level at 1.49 Mev. The yield curve for the reaction $C^{13}(p,n)N^{13}$ shows energy levels at 11.07 and 11.21 Mev. The γ ray accompanying the decay of the excited state of Li^7, one of the product nuclei from the splitting of the compound nucleus B^{11}, has been measured and found to have an energy of 0.480 Mev. Operation of a chamber for measuring neutron energy by electronic detection of collimated proton recoils is discussed. Pulse-height distribution curves have been obtained for the response of anthracene crystals to protons, for the relative counting rate as a function of pulse height, and for the pulse height of a given energy as a function of the particle energy. A study has been made of equipment capable of determining the pulse-amplitude spectrum of a series of pulses whose duration may be as short as 0.5 μsec and whose separation is less than 1 μsec. Characteristic curves are shown for the acorn-type tube, 9004 diode, when operated as a logarithmic element.

5350

THE LOCATION OF LITERATURE ON ATOMIC ENERGY. Fred E. Croxton. Coll. and Research Libraries 12, 103-8 (1951) Apr.

The results of atomic energy research which are available to the public are located in the National Nuclear Energy Series, standard technical periodicals and serial separates published by the U. S. AEC and other agencies supporting atomic energy research. The most complete index to this information is furnished in Nuclear Science Abstracts and its predecessors, Abstracts of Declassified Documents and Guide to Published Research on Atomic Energy. Additional useful keys are the bibliographies prepared by the AEC and others, and the standard technical abstracting ing and indexing services.

NUCLEAR PROPERTIES

5351

Brookhaven National Lab. and Watertown Arsenal

COHERENT NEUTRON SCATTERING CROSS-SECTION OF V^{51}. A. W. McReynolds and R. J. Weiss. Apr. 24, 1951. 7p. (AECU-1412)

The coherent cross section of V has been determined by the total reflection of a thermal-neutron beam from a mirror surface of V. σ_{coh} was compared to σ_{coh} of N_2 (= 9.1 barns) by observing the decrease in reflectivity as the pressure of N_2 gas surrounding the mirror was increased until, at P_0, its index of refraction equaled the index of refraction of V, giving no reflection. It is shown that σ_0 (mirror) = $\left[\frac{n P_0}{n_0}\right]^2 \sigma$(gas) where n and n_0 are nuclei per cc in the gas and mirror, respectively, and thus that σ_{con} (V) = 0.028 ± 0.005 barn (positive phase).

5352

Brookhaven National Lab. and Argonne National Lab.

FAST NEUTRON CAPTURE CROSS SECTIONS AND SHELL STRUCTURE. (abstract) D. J. Hughes, R. C. Garth, and C. Eggler. Mar. 1, 1951. 1p. (AECU-1547)

The report is reproduced here in its entirety.

The capture cross section for 1-Mev neutrons is a direct measure of the average level density in the compound nucleus at an excitation energy equal to the neutron binding plus 1 Mev. Previous cross-section results (Hughes and Sherman, Phys. Rev. 78, 632 (1950)) obtained with fission neutrons (effective energy 1 Mev) have shown clearly the increase in level density with atomic weight and the marked decrease in level density (associated with decreased neutron binding energy) at the nuclear shells. The measurements have been continued with special attention to nuclei near the complete shells. The level density for nuclei just above the 82-neutron shell is low but rises to normal at 90 neutrons. The low cross sections for several Ru and Mo isotopes indicate a hitherto unreported shell at 58 neutrons. Several isotopes with neutron number near 110 exhibit a normal level density. The explanation of the observed cross-section variation involves both the single particle nuclear model (low binding for neutrons in excess of filled shells) and the statistical model (rapid variation of level density with excitation energy).

5353

Wisconsin Univ.

CLASSIFICATION OF N^{13} LEVELS BY PARTIAL WAVE ANALYSIS OF PROTON SCATTERING FROM C^{12}. Herbert L. Jackson and Aaron I. Galonsky. [nd] 27p. (AECU-1561)

The nature of the excited levels in N^{13} between 2.24 and 5.64 Mev was investigated by analyzing the $C^{12}(p,p)C^{12}$ data of Goldhaber and Wilkinson. To carry out the analysis, the partial wave phase shifts were related to the level parameters by means of one-level dispersion theory. Then by successive approximations of the level parameters, the partial wave expansion of the differential cross section for elastic scattering was fitted to the experimental curve. The analysis leads to the conclusion that the lower scattering anomaly is due to an $S_{1/2}$ level at 2.379 Mev above the ground state, and that the higher scattering anomaly results from a $P_{3/2}$ level at 3.501 Mev and a $D_{5/2}$ level at 3.549 Mev. Neither experiment nor analysis indicate any other levels in the range considered. It is shown that no other simple level assignment can account for the observed scattering cross section. The appearance of levels with $j = l + \frac{1}{2}$ instead of $j = l - \frac{1}{2}$ supports Mayer's hypothesis of level inversion in nuclei. The widths and energies of the levels obtained from the present analysis are in partial agreement with the values obtained from the (p,γ) reaction. (auth)

5354

Wisconsin Alumni Research Foundation

TOTAL CROSS SECTION OF NITROGEN FOR FAST NEUTRONS. C. H. Johnson, B. Petree, and R. K. Adair. [nd] 17p. (AECU-1580)

The total neutron cross section of N has been measured by a simple transmission method (Adair et al., Phys. Rev. 75, 1124(1949)). Resonances in the total cross section are observed at 0.433, 0.640, 1.00, 1.12, 1.35, and 1.45 Mev. The second, third, and last of these resonances correspond in energy to resonances observed in the neutron disintegration of N. Application of the nuclear dispersion theory indicates that the resonances at 0.64 and 1.00 Mev are caused by neutrons of zero orbital angular momentum forming compound states of spin ½ and ⅜, respectively. An experiment is proposed which would, in conjunction with these measurements, determine the relative parity of C^{14} and N^{14}. (auth)

5355

Columbia Univ.

NEUTRON RESONANCES OF TELLURIUM. C. Heindl and I. W. Ruderman. May 23, 1951. 9p. (CUD-93)

The best possible theoretical Breit-Wigner single-level resonance curve was fitted to neutron cross-section curves obtained from both Te^{123}-enriched and normal Te. Taking into account the abundance of each isotope in these two samples, two values of $\sigma_0\Gamma^2$ were calculated for each isotope. For only one isotope was good agreement obtained,

namely, for Te^{123}, for which $\sigma_0\Gamma'^2$ was found to be 900 ± 100 barns ev. Assignment of the remaining resonances is being carried out in this way with the use of a thinner sample of normal Te and better resolution of the spectrometer. The total cross section of normal isotopic Te has also been determined for neutron energies at which there are neither resonances nor diffraction effects and gives a value for the capture cross section at 0.025 ev of 4.43 barns. The incoherent scattering cross section of normal Te was determined as 0.6 ± 0.15 barn, using the neutron velocity spectrometer and a forward scattering apparatus.

5356

Oak Ridge National Lab., Y-12 Area

THE NUCLEAR MAGNETIC MOMENT OF I^{129}. H. E. Walchli and R. Livingston. Aug. 8, 1951. 14p. (Y-802)

The magnetic moments of I^{129} and I^{127} have been determined by nuclear resonance using the nuclear induction system (W. G. Proctor, Phys. Rev. 79, 35(1950)). The ratios of the resonance frequencies of the iodines to that of deuterium have been measured and from this the magnetic moments have been determined to be +2.6173 nuclear magnetons for I^{129} and +2.8090 nuclear magnetons for I^{127}. (auth)

5357

Atomic Energy Research Establishment, Harwell, Berks. (England)

THE CLASSIFICATION OF STATES OF THE NUCLEAR f-SHELL. B. H. Flowers. Feb. 28, 1951. 23p. (AERE-T/R-679)

Following the methods of Racah (Phys. Rev. 76, 1352(1949)) and of Jahn (Proc. Roy. Soc. (London) 201A, 516(1950)) the orbital states arising from the nuclear configuration f^n in Russell-Saunders coupling are classified by means of group theory. States are classified according to the irreducible representations of the permutation group, and of the rotation group in the seven-dimensional space spanned by the orbital states of a single f-particle. On the assumption of short-range attractive forces, this classification allows predictions regarding the ordering of levels in the f-shell; and, in particular, the lowest states of nuclei which contain only the simple f^n configuration (apart from closed shells) may be predicted as a function of the isotopic number. Numerical values of the Slater integrals for the f-shell with a Gauss interaction are given as a function of the range of the interaction. (auth)

5358

Atomic Energy Project (Canada)

NEUTRON CAPTURE γ-RAYS FROM CALCIUM. B. B. Kinsey and G. A. Bartholomew. [nd] 4p. (NP-3137)

In a study of the neutron-capture γ rays from Ca, a block of Bi was placed over a hole in the Chalk River pile to remove the pile γ radiation from the neutron beam. A sample of Ca in an Al can was placed next to the Bi block, and the γ radiation emitted from the Ca was studied with a pair spectrometer. The coincidence spectrum of Ca is dominated by a very strong γ ray at 6.42 ± 0.03 Mev and weaker γ rays at energies between 7 and 8 Mev. Although most of the neutron capturing must be by Ca^{40} (97% abundance), the activity of Ca^{41} has not been found.

5359

NUCLEAR SPIN RELAXATION STUDIES IN DILUTE SODIUM-LIQUID AMMONIA SOLUTIONS. R. Newman and R. A. Ogg, Jr. J. Chem. Phys. 19, 214-17(1951) Feb.

The nuclear spin relaxation times of the protons in dilute solutions of sodium in liquid ammonia have been measured at 30 Mc over the room temperature–dry ice range. The data can be interpreted on the basis of an associative equilibrium existing between paramagnetic and diamagnetic solute species. This is in agreement with the results of the conventional magnetic susceptibility measurements. The paramagnetic component of the solutions seem to be about one-tenth as effective as a cupric ion in inducing nuclear relaxation. (auth)

NUCLEAR REACTORS

5360

Oak Ridge National Lab.

MEASUREMENTS OF THE ORSORT URANIUM-GRAPHITE EXPONENTIAL PILE; OAK RIDGE SCHOOL OF REACTOR TECHNOLOGY. Edward C. Campbell, L. D. Wyly, and E. I. Howell. Oct. 30, 1950. 28p. (AECD-3169; ORNL 860)

The Oak Ridge School of Reactor Technology (ORSORT) pile is described in some detail. Results are presented of measurements made on the neutron flux distribution and the Laplacian of the pile.

5361

Los Alamos Scientific Lab.

MATERIAL LIMITATIONS FOR WATER BOILER. R. F. Christy. Sept. 11, 1943. Decl. June 6, 1951. 5p. (AECD-3170; LADC-915)

A table is presented in which are specified the amounts of various elements permissible in the solution-containing shell and the percentages of the various elements permissible as impurities in BeO and Bi. The radiation tolerances used are 0.1 r in 1 hr for Bi and shell and 0.1 r in 0.1 hr for BeO. The limits due to neutron absorption are also included, and the more stringent of the two requirements is in each case used.

5362

National Bureau of Standards

GAMMA RAY SPECTRA OF LOS ALAMOS REACTORS, "WATER BOILER" AND CLEMENTINE. J. W. Metz. [nd] Decl. July 5, 1951. 29p. (AECD-3188; LADC-961)

The γ-ray beams emerging through the collimator hole of the Los Alamos Water Boiler (which contained a U^{235} slug in the glory hole) and of the Los Alamos Fast Reactor, were examined with a magnetic spectrometer. The γ rays ejected Compton electrons from a Be radiator in the spectrometer. Only those electrons confined to a narrow cone in the forward direction of the γ-ray beam were detected, so that monoenergetic γ rays yield a "line" for the Compton electron momentum measurements rather than the usual continuous distribution. With each reactor operating at full power, the electron momentum spectrum was measured. From the Klein-Nishina formula and the spectrometer calibration, the observed measurements were converted to a corresponding γ-ray spectrum which expressed the number of photons per unit energy interval incident on the radiator per cm^2/sec as a function of the incident photon energy. An independent check of this conversion to absolute photon intensities was made by measuring the intensities of the γ-ray lines from Cs^{137} (0.661 Mev) and Na^{24} (1.38 Mev, 2.76 Mev) with an extrapolation ionization chamber, and comparing the calculated and measured values of the number of Compton electrons/sec detected by the spectrometer. The γ-ray spectrum from each reactor covered a range from 0.5 to 12 Mev. At 8 Mev, the photon intensity for each spectrum was reduced by a factor of 10^4 compared to that at 0.5 Mev. The shapes of both spectra appear to be a straight line on a semilog plot, with approximately the same slope for each line. (auth)

5363

Hanford Works

INTRODUCTION TO PILE PHYSICS; LECTURE NOTES; PART 1. P. F. Gast. Nov. 15, 1950. 98p. (HW-19474)

Course lecture notes from a series of lectures on pile physics have been compiled. Subjects considered include neutron reactions; the fission process; neutron diffusion; slowing down of neutrons—slowing down density, slowing

down with absorption, space distribution of slowed down neutrons, slowing down with diffusion and absorption; neutron cycle in the pile; solution for the differential equation—the buckling (B), connection between B and leakage; outline of Bessel functions (arising from the solution of the pile equation); action of the reflector in thermal piles studied by the use of the two group theory; determination of the multiplication constant K; equations defining the critical state of the pile.

5364

North Carolina State Coll.

PROGRAM ADMINISTRATION AND INSTALLATION DESIGN OF THE NUCLEAR REACTOR PROJECT AT NORTH CAROLINA STATE COLLEGE. Clifford K. Beck, Arthur C. Menius, George N. Webb, Arthur W. Waltner, P. B. Leonard, E. H. Stinson, and J. D. Paulson. July 5, 1950. Decl. Sept. 6, 1951. 79p. (ORO-33)

North Carolina State College of The University of North Carolina has proposed that a "water-boiler" nuclear reactor be built and operated on the college campus as an unclassified tool of instruction and research. A brief statement of the reactor project objectives and administrative procedure is made in this report. The main body of the report concerns the general design and arrangement of the reactor. Most of the design has been based on ideas and extension of ideas and empirical data from Los Alamos and Oak Ridge reactors. The hazards normally associated with operation of any reactor, possible emergency hazards, and the safeguards provided are discussed. A number of precautions against sabotage are included in the design.

5365

Commissariat à l' Énergie Atomique

TEMPERATURE MEASUREMENT IN FRENCH ATOMIC PILES. (In French). J. Weill and G. Rastoix. Oct. 1950. 10p. (CEA-51).

In the Châtillon reactor the temperature is measured (1) in the interior of one of the vertical Al cylinders filled with UO_2 (temperature interval 20 to 70°C), and (2) in the center of the tank containing D_2O (20 to 50°). The instruments used are silver-constantan thermocouples; the wires are insulated by SiO_2 sheaths, those immersed in D_2O being placed within Al cases 10 mm diam. In the Saclay reactor the temperature is taken (1) in the interior of 4 U rods (20 to 300°), (2) at 2 points of the D_2O mass (20 to 60°), (3) at one point in graphite (20 to 100°), and (4) at 5 points in the catalytic setup (200°). Copper-constantan couples are used (Ag-constantan is not suitable above 150°); the wires are enclosed in a sheath of glass fabric. In both reactors the accuracy of the temperature measurements is 0.5°.

NUCLEAR TRANSFORMATIONS

5366

Argonne National Lab.

SCINTILLATION COUNTER STUDIES OF NEUTRON CAPTURE GAMMA-RAY SPECTRA. Bernard Hamermesh and Virginia Hummel. May 24, 1951. 3p. (AECU-1356; UAC-390)

A NaI crystal and photomultiplier are being used in a study of neutron-capture γ-ray spectra in the energy range 300 kev to 10 Mev. Results so far obtained for Al, Cl, Fe, and Mn are reported, and an interpretation of the peaks is given.

5367

Wisconsin Univ.

CAPTURE OF PROTONS BY OXYGEN. M. J. W. Laubenstein, R. A. Laubenstein, L. J. Koester, and R. C. Mobley. [nd] 1p. (AECU-1382)

This report is reproduced here in its entirety.

The capture cross section of oxygen for protons has been measured for incident proton energies from 1.4 to 4.1 Mev by counting the positrons from the decay of the F^{17} built up under the bombardment of oxidized tantalum targets. A method for compensating for fluctuating beam current was used and aluminum absorbers were used to prevent the counting of positrons from F^{18}. The cross section increases almost linearly with proton energy up to a maximum at 4 Mev except for a sharp resonance at 3.47 Mev. The effect of the level at 2.66 Mev was not detectable within the experimental error. The half life of F^{17} was measured as 66.3 ± 1 sec. An estimate of the beta-ray end point obtained from absorption measurements gave 1.75 ± 0.2 Mev. The correspondence of the levels in F^{17} and its mirror nucleus O^{17} will be shown.

5368

Wisconsin Univ.

TOTAL CROSS SECTIONS OF LIGHT NUCLEI FOR p,T NEUTRONS. (abstract) C. K. Bockelman, H. H. Barschall, and D. W. Miller. [nd] 1p. (AECU-1417)

The report is reproduced here in its entirety.

Measurements of the energy dependence of total neutron cross sections of light nuclei were extended to higher energies by the use of the T(p,n) reaction as a source of monoenergetic fast neutrons. Tritium was absorbed in a Zr film evaporated on a tungsten disk, and was bombarded with protons from the electrostatic generator. Neutrons of energies up to 3.5 Mev were produced with a 20-kev energy spread. Narrow cross-section peaks were observed for Be, C, and O. For Li, only a gradual rise in cross section was found. A comparison of measurements on normal B with those on enriched B^{10} gave the cross sections of B^{10} and B^{11}. For B^{10} only two broad maxima were observed, while the cross section of B^{11} shows five sharp peaks. In addition to these relatively narrow resonances, evidence was found for very broad levels in all the nuclei studied.

5369

Wisconsin Univ.

NEUTRONS FROM THE DEUTERON BOMBARDMENT OF O^{16}. (abstract) Fay Ajzenberg. [nd] 1p. (AECU-1418)

The report is reproduced here in its entirety.

A thin tungsten oxide target was bombarded by 3.083-Mev deuterons from the Wisconsin electrostatic generator. The neutron spectrum was observed by means of Eastman NTA nuclear emulsions, 100 μ thick, mounted at 10 cm from the target, and at angles of 0°, 10°, 20°, 30°, and 90° to the beam. A total of 800 proton recoil tracks have been measured so far. These preliminary measurements indicate a level at 0.55 ± 0.02 Mev above the ground state of F^{17}. The intensities of the neutron groups as a function of angle, if interpreted on a stripping hypothesis (Butler, Phys. Rev. 80, 1095 (1950)), favor L = 0 deuterons producing the first excited state (and hence an $S_{1/2}$ state), but do not distinguish clearly between L = 1 and L = 2 deuterons for the ground state transition. Mirror nuclei arguments predict that the ground state of F^{17} should be the same as the ground state (Alder and Yu, Phys. Rev. 81, 1067 (1951)) of O^{17} and hence $D_{5/2}$. The present data are consistent with such an assignment.

5370

Argonne National Lab.

RECOIL ATOMS FROM SLOW NEUTRON CAPTURE BY GOLD AND INDIUM SURFACES. Samuel Yosim and T. H. Davies. June 1951. 17p. (AECU-1460; UAC-399)

In considering the characteristics of recoil atoms with kinetic energies of ~100 ev produced by nuclear processes, it is first noted that the n,γ reaction presents difficulties due to multiple γ emission, internal conversion and com-

plementary complexity in the recoil spectrum. Then a discussion is given of experiments on In and Au recoils from slow-neutron capture. The apparatus is described and diagramed, and results are tabulated. No effect of backing on metal source films is apparent. The data show the presence of + ions among both In and Au recoils and suggest that the recoils penetrate at most only a few lattice layers of the metal film. The yields are not far from expectation, although all predicted recoils from the surface layer do not reach the collector. The charge on about half the recoils apparently arises from internal conversion during deexcitation of the compound nucleus. The probable chronology of events is discussed, and it is noted that the internal conversion step must follow after the emission of an energetic γ ray in order for the ions to reach the collector without being neutralized.

5371

Iowa State Coll.

MEASUREMENTS OF ELECTRON PAIRS FOR THE DETERMINATION OF A 65-MEV X-RAY SPECTRUM. Richard H. Stokes. July 9, 1951. 15p. (AECU-1477)

A magnetic cloud chamber has been used to observe electron pairs produced by the beam of a synchrotron operating at 65 Mev. The apparatus and experimental procedures are discussed at length. The cross section for pair production given by the Bethe-Heitler theory was used to obtain the x-ray energy spectrum, and the observed spectrum was in agreement with that expected theoretically. The value for the quantum flux obtained was 6.6×10^7 quanta/cm^2 per r unit of a Victoreen thimble ionization chamber, for the energy range to 10 to 65 Mev. Corresponding to this value the energy flux is found to be 2.2×10^9 Mev/cm^2/r unit for the energy range 0 to 65 Mev.

5372

Los Alamos Scientific Lab.

ANGULAR DISTRIBUTION OF PROTONS FROM THE D(d,p)T REACTION AT 10.3-MEV BOMBARDING ENERGY. J. C. Allred, D. D. Phillips, and Louis Rosen. [nd] 17p. (AECU-1497; LADC-959)

The differential cross section of the D(d,p)T reaction for 10.3-Mev bombarding deuterons has been measured by a nuclear emulsion technique, using a multiple nuclear-plate camera. Values of the cross section are given over essentially the entire range of the center-of-mass angle. The results are fitted within experimental error by the expression: $\sigma(\cos\Omega) = 6.24\ P_0 + 8.28\ P_2 + 13.16\ P_4 + 8.24\ P_6 + 2.31\ P_8$ where Ω is the center-of-mass angle, σ is expressed in millibarns per unit solid angle, and the B_i's are Legendre polynomials. For angles between 20 and 160° the average rms absolute standard error is ±3.8%. For angles greater than 160° and less than 20° this error approaches ±5%. (auth)

5373

Wisconsin Alumni Research Foundation

PROTON BOMBARDMENT OF THE LITHIUM ISOTOPES. S. Bashkin and H. T. Richards. [nd] 27p. (AECU-1571)

Thin targets of ordinary Li have been bombarded by protons over the energy range 0.4 to 3.6 Mev. The reaction was magnetically analyzed, and observations of the scattered particles were made at 164° to the incident beam. Differential cross-section curves were obtained for protons scattered elastically and inelastically from Li^7 and elastically from Li^6 and for the He^4 and He^3 particles from the $Li^6(p,\alpha)He^3$ reaction. The Li^6 data show an excited state in Be^7 at about 7.3 Mev and also a lower and very broad state. Possible correspondence to levels in the mirror nucleus Li^7 is discussed. The protons scattered inelastically from Li^7 do not show any resonances above a proton energy of 1.5 Mev in laboratory coordinates. The Li^7 elastic scattering cross section has maxima at proton energies of 1.05, 1.88, and 2.06 Mev. (auth)

5374

Argonne National Lab. and Inst. for Nuclear Studies, Univ. of Chicago.

RADIOCHEMICAL STUDIES ON THE FISSION OF Th^{232} WITH PILE NEUTRONS. (Based on AECD-2862) A. Turkevich and J. B. Niday. May 31, 1951. 24p. (ANL-4649)

The relative yields of more than 20 products in thorium fission have been determined radiochemically. Pile neutrons with an estimated effective average of 2.6 Mev were used. The data have been used to construct a complete fission yield curve for Th^{232}, which is compared with the yield curves of other fissionable nuclei. Thorium fission is similar to the neutron fission of U^{235}, U^{233}, Pu^{239}, and U^{238} in being highly asymmetric. With the neutrons used in this work the peak yields occur 110 times as frequently as symmetrical products. The most probable light mass is 91 and the most probable heavy mass 140. (auth)

5375

Los Alamos Scientific Lab.

TOTAL CROSS SECTIONS FOR 14-MEV NEUTRONS. D. I. Meyer and Warren Nyer. July 16, 1951. 8p. (LA-1279)

Total cross sections of carbon, polyethylene, water, heavy water, formic acid, nitrogen, and copper for 14.2-Mev neutrons from the $T(d,n)He^4$ reaction have been obtained from "good geometry" transmission experiments. Copper strips wrapped in tight spirals were used to detect the neutrons by the $Cu^{63}(n,2n)Cu^{62}$ reaction. The scatterers were located midway between the source and the detector. A detector spiral and a monitor spiral were 90 cm from the source and were 90 cm apart. Cross sections were evaluated by the relation $\sigma = 1/nx \log 1/T$, where n is the number of atoms or molecules per cubic centimeter, x is the length of the scattering sample in centimeters, and T is the transmission corrected for the effect of room-scattered neutrons. Results are tabulated.

5376

Johns Hopkins Univ.

ANNUAL REPORT. S. S. Hanna. Nov. 30, 1950. 8p. (NYO-554)

Brief statements are made concerning (1) angular distribution studies of the $Li^7(p,p')Li^{7*}(\gamma)Li^7$ reaction and (2) the existence of directional correlation in the reactions $F^{19}(p,\gamma')O^{16*}(\gamma)O^{16}$, $Li^7(p,\gamma)Be^8$, $H^3(p,\gamma)He^4$, and $H^2(p,\gamma)He^3$.

5377

Radiation Lab., Univ. of Calif.

EXCITATION FUNCTIONS FOR Bi (p,xn) REACTIONS AT HIGH ENERGIES. D. G. Karraker. Apr. 12, 1951. 16p. (UCRL-1202)

For the first time an investigation is made of excitation function in the 10^8-v range for yields of a series of products of the (p,xn) reactions from a single target. The isotopes of Po produced by proton bombardment of Bi^{209} were studied; yields and cross sections for the (p,2n), (p,4n), (p,6n), and (p,8n) reactions on Bi being determined for proton energies of 70 to 345 Mev. A hypothesis is advanced to account for the ratio of the yields of the Po products at high energies.

5378

Radiation Lab., Univ. of Calif.

SUMMARY OF THE RESEARCH PROGRESS MEETING OF NOVEMBER 16, 1950. Margaret Foss Folden. Apr. 4, 1951. 7p. (UCRL-1205)

More than 300,000 tracks in Ilford E-1 plates exposed to the C^{12} and C^{13} beam have been examined. No α emission was observed at the end of the tracks, and no evidence was found for fission fragments when Au foil was placed over the plates. Stars of 2, 3, 4, and 5 prongs have been seen. The cross section for star production is 0.49 barn. Very little

discussion is given, but three photographs illustrate the apparatus and typical tracks.

A completely separate study is being made of the β group of lipoproteins. So far eight classes have been identified within the β' group. By labeling the molecules with various radioactive atoms such as P^{32} and H^3, it has been found that the turnover rate is 16 to 20 min. The association of lipoproteins with arterial sclerosis and with thyroid disturbances is discussed but no conclusive results have been achieved.

5379

California Univ., Berkeley

INVESTIGATIONS OF SOME UNUSUAL NUCLEAR REACTIONS AND STUDY OF DOUBLE BETA DECAY. (dissertation) Hari Dutta Sharma. May 1951. 43p. (UCRL-1265)

An attempt has been made to present a theoretical derivation for the calculation of cross sections for such reactions as (d,γ), (α,γ), (α,2p), (d,2p), (α,α2p), and (p,4p). The derivation is based on a statistical model, and the experimentally determined values of the cross section for the reactions have been discussed on the basis of the theory. Chapter II contains the result of the study of double β decay in Se^{82} and Te^{130}. Bromine and iodine, respectively, were milked from the above nuclides and examined, and upper limits for half life of the decay of Se^{82} and Te^{130} were calculated. The calculations were based on secular equilibrium between the parent and the daughter in the naturally occurring elements.

5380

Radiation Lab., Univ. of Calif.

EXCITATION FUNCTIONS FOR DEUTERONS AND PROTONS ON Mg. F. O. Bartell and Sheldon Softky. June 20, 1951. 15p. (UCRL-1357)

Yields of F^{18}, Na^{22}, and Na^{24} were measured as a function of energy for both deuterons and protons on Mg. In some cases the yield of a single isotope can be attributed to a single nuclear reaction over a certain energy interval, this being done by a consideration of thresholds. These excitation curves are given over the ranges 0 to 20 Mev and 0 to 190 Mev for deuterons and from 0 to 31 Mev for protons. (auth)

5381

Radiation Lab., Univ. of Calif.

Li^9—NEW DELAYED NEUTRON EMITTER. W. L. Gardner, N. Knable, and B. J. Moyer. June 22, 1951. 6p. (UCRL-1360)

Li^9 is reported as being a delayed neutron emitter. The Li^9 decay scheme is $Li^9 \rightarrow Be^{9*} + \beta^-$, $Be^{9*} \rightarrow Be^8 + n$. Li^9 and the foregoing decay scheme hold an analogous position in the isotope chart to that of N^{17}. A mass calculation of Li^9 by Barkas (Phys. Rev. 55, 691(1939)) permits a threshold for the reaction $Be^9 + d \rightarrow Li^9 + 2p$ to be estimated as $\cong$18.5 Mev. Experimental data on this point were obtained by moving a Be target in along the radius of the cyclotron gap and through the deuteron beam. The threshold determined from the intercept at zero yield is 19 $\pm$ 1 Mev, which is in agreement with the calculated threshold. The Li^9 mass indicates that a positron energy of ~11 Mev is quite likely.

5382

Radiation Lab., Univ. of Calif.

THE RADIATION CHARACTERISTICS OF Cm^{240} AND Cm^{241}. G. H. Higgins and K. Street, Jr. June 27, 1951. 4p. (UCRL-1374)

The curium isotopes of mass numbers 240, 241, and 242 were produced in varying ratios by bombarding Pu^{239} with helium ions. α particles and the conversion and Auger electrons accompanying orbital-electron capture were followed on a windowless proportional counter. α particles of specific energies were followed on the 48-channel differential pulse analyzer. Activities were observed and assigned as follows: a 27-day, 6.25-Mev α activity to Cm^{240}, a 35-day, 5.89-Mev α and electron-capture activity to Cm^{241}, and a 162-day 6.08-Mev α activity to Cm^{242}. Less than 0.5% of the Cm^{240} decayed by electron capture to produce the 52-hr activity of Am^{240}. The ratio of the number of electron-capture disintegrations to the number of α disintegrations in the 5.89-Mev group was calculated to be between 360 and 460.

5383

Radiation Lab., Univ. of Calif.

NUCLEAR TRANSMUTATIONS USING ACCELERATED CARBON IONS. Jack Marvin Hollander. July 1951. 64p. (UCRL-1396)

Excitation experiments have been done with the Au^{197}(C,4n)At^{205} and Au^{197}(C,6n)At^{203} reactions using the stacked-foil technique. Results are discussed in terms of the statistical theory of nuclear reactions. Cross sections for these two reactions are also estimated. The fission of U with C ions has been studied, and the observed cross section compared with that estimated from yields in the U^{238}(C,6n)Cf^{244} reaction. The general theory of C ion induced fission is discussed. Bombardments of Cu with C ions have resulted in the production of a new isotope of Br, tentatively assigned to Br^{74} produced by a Cu^{65}(C,3n)Br^{74} reaction. Also observed was 1.6-hr Br^{75}. The mass assignments of Br^{76} and Br^{77} have been verified by bombarding As_2O_3 with He ions of various energies. (auth)

5384

Atomic Energy Research Establishment, Harwell, Berks. (England)

THE REACTION ^{10}B (γ,d) 2 ^4He. M. J. Brinkworth and E. W. Titterton. Feb. 15, 1951. 7p. (AERE-G/M-83)

The reaction $B^{10} + h\nu \rightarrow 2\ He^4 + H^3 - 5.89$ Mev was investigated with the 440-kev resonance γ rays from Li^7(p,γ). Ilford E1 emulsions loaded with B^{10} were used. From histograms of γ-ray energy and of Q values of the observed events it is concluded that the reaction probably proceeds through B^{10}(γ,d)Be^{8*} and $Be^{8*} \rightarrow 2\ He^4$.

PARTICLE ACCELERATORS

5385

Case Inst. of Tech.

NUCLEAR PHYSICS PROGRAM; PROGRESS REPORT FOR THE PERIOD JULY 1, 1950, TO SEPTEMBER 15, 1950. [nd] 10p. (COO-17(suppl.))

During operation of the betatron, with the expansion circuit not in operation, the electron beam self-expanded and struck the target later in the cycle. For example, with a-c operation alone, the beam self-expanded at 101° (injection at 0°) and the addition of d-c bias to the guiding field (injection at −20°) increased this self-expansion angle to 142°. A more important observation, however, was that under self-expansion conditions, the γ-ray pulse increased to about 150 μsec in length, which is extremely helpful in improving counting statistics during most experiments with the machine. This pulse length is to be compared with about 3 μsec under the usual forced expansion conditions. In monitoring beam intensity it was found that at high energies "r" meters are influenced by their surroundings, through fluorescent radiation, even though the meters are placed between the source and a block of lead.

5386

Carnegie Inst. of Tech.

MATHEMATICAL TECHNIQUES FOR DESIGNING FIELD SHAPES. Martyn H. Foss. July 11, 1951. 34p. (NYO-911)

Calculations are presented for the contour of the pole tips of the Carnegie Institute of Technology cyclotron magnet, which reduced the amount of cut-and-try method in the central region of the gap and also resulted in a field with an unusually large fraction of the radius useful for ion acceler-

ation. Expressions are developed for the spherical harmonics which are convenient for determining the equipotential surfaces which produce a field with a simple power series dependence on radius. A raised edge on the pole tip improves the radius, a valley inside of the raised edge improves it further, a second ridge inside the valley still further, and so forth. Useful radius gained by infinite complication is small. The analysis for development of the shim is presented.

5387
Carnegie Inst. of Tech.
SYNCHRO-CYCLOTRON PROGRESS REPORTS COVERING THE PERIOD JULY 1947 THROUGH JUNE 1950. July 6, 1951. 141p. (TID-453)

Reports of progress on the Carnegie Institute of Technology synchro-cyclotron have been brought together, allowing an over-all concept of the design and development of the synchro-cyclotron to this date.

5388
Radiation Lab., Univ. of Calif.
BIBLIOGRAPHY OF PARTICLE ACCELERATORS; JULY 1948 TO DECEMBER 1950. Bonnie E. Cushman. Mar. 1951. 56p. (UCRL-1238)

This bibliography is a supplement to that compiled and edited by Thomas, Mittelman, and Goldsmith, issued July 1, 1948, as BNL-L-101. The journals searched were Chemical Abstracts; Science Abstracts, Section A (Physics) and Section B (Electrical Engineering); Nuclear Science Abstracts; and Nucleonics. Information pertaining to particle accelerators was obtained primarily from a list of questions sent to institutions throughout the world. Included are about 380 references, a table of particle accelerators in the United States, and one of foreign accelerators.

5389
Radiation Lab., Univ. of Calif.
ENERGY DOUBLING IN D. C. ACCELERATORS. Luis W. Alvarez. Apr. 20, 1951. 5p. (UCRL-1249)

A new proton accelerator is suggested. H^- and D^- ions would be accelerated from ground potential to an electrode at +V volts. At this point the H^- or D^- ions would be stripped of two electrons by a thin foil, forming H^+ or D^+. The protons or deuterons would then be accelerated back down to ground potential, giving an acceleration double the effective voltage of the accelerator. Such an accelerator is now being designed at UCRL to give 4-Mev protons.

5390
Radiation Lab., Univ. of Calif.
FREQUENCY PERTURBATION METHOD OF FIELD MEASUREMENT IN AN ELECTROMAGNETIC RESONATOR. John F. Waddell. July 18, 1951. 10p. (UCRL-1392)

A method is outlined for deducing the magnitude of the field vectors $\underline{E}$ and $\underline{H}$ in a cavity resonator by measurement of the perturbation in frequency resulting from an adiabatic perturbation in stored energy of the system which occurs when a foreign body is introduced into the cavity.

5391
Atomic Energy Research Establishment, Harwell, Berks. (England)
THE CALCULATION OF THE MULTIPLE TRAVERSALS OF CYCLOTRON TARGETS. J. M. Dickson. Feb. 1951. 13p. (AERE-G/R-660)

In the irradiation of targets in the internal beam of a cyclotron the effective current of ions is generally greater than the true beam current, due to multiple traversals of the target by the ions. A method of calculating the multiple traversals is given, together with graphs relating the number of traversals to the target thickness.

5392
National Research Council, Canada
PROGRESS REPORT; JULY–SEPTEMBER 1950; RADIO AND ELECTRICAL ENGINEERING DIVISION. Oct. 1950. 45p. (ERA-189; ATI-96562)

A new type of electron accelerator has been constructed and is described. This accelerator operates with a constant magnetic field and an accelerating potential of at least 500 kv developed across a resonant cavity. The accelerating power is derived from a 10-cm magnetron. Final energies greater than 4 Mev are obtained. Brief statements are made concerning the status of various other projects of the Radio and Electrical Engineering Division.

5393
Microwave Lab., Stanford Univ.
THE THEORY OF LINEAR ELECTRON ACCELERATORS. E. L. Chu. May 1951. 242p. (ML-140)

This work deals mainly with two basic subjects in the theory of linear electron accelerators, the accelerating field and the electron orbits. The discussion of the field problem begins with a résumé of the existing theory of wave propagation in periodic structures with particular reference to the accelerator tube, that is, a disk-loaded waveguide; then it proceeds with different methods of solution, both rigorous and approximate, including the formulation of a variational method credited to Schwinger, and with numerical results. Both the longitudinal and the transverse orbits are discussed with neglect of space charge. The cases considered are classified according to two dimensionless parameters, the field amplitude α and the phase velocity β. Particular emphasis is placed on the most important and the simplest case α = constant, $\beta = 1$. Analytic solutions under different restrictive conditions are obtained, and numerical examples are given. The numerical solutions for several specific designs are also described. Various aspects of the bunching and focusing problems are discussed in detail, including a study of the case of rapidly varying parameters. Besides the basic subjects, the discussion covers the field energy and related quantities, such as the group velocity, energy velocity, attenuation, Q, and shunt impedance, thus connecting the theory with design and operation, and furnishing a clear picture of linear acceleration process. The loss in acceleration due to random constructional errors is also discussed. 65 references. (auth)

RADIATION ABSORPTION AND SCATTERING

5394
Brookhaven National Lab.
THE SCATTERING OF 4.5- AND 5.5-MEV NEUTRONS BY DEUTERONS. E. Wantuch. Apr. 11, 1951. 17p. (AECU-1383)

Neutrons of 4.5- and 5.5-Mev energy were produced by bombarding a thin D_2 gas target with deuterons. Deuterons recoiling from neutron collisions in (a) a thin heavy paraffin scatterer and (b) a gas sample, were detected by a double coincidence counter telescope. The angular distribution of recoiling deuterons, measured from 0 to 60° in the laboratory system, shows a sharp maximum for neutron scattering at 180° with a minimum at approximately 110° in the center-of-mass system. The ratio of the differential cross section at 180° to that at 110° is 5:1 for both energies. The experimental curves are compared with the theory of Buckingham and Massey (Proc. Roy. Soc. (London) 179A, 123(1941)). (auth) (See also NSA 4-3792 and 4-5960)

5395
Brookhaven National Lab.
THE INDEX OF REFRACTION FOR NEUTRONS. David

Kleinman and George Snow. Apr. 17, 1951. 3p. (AECU-1389)

A general derivation of the index of refraction of gases, liquids, and solids for neutrons is derived from a formal solution to the stationary eigenvalue problem. The derivation shows that there is no Doppler effect due to the motion of the individual nuclei. The variational principle gives, beside the Fermi approximation, a temperature-dependent correction to the simple formula, thereby taking into account the effect of virtual inelastic interactions of the neutron with the material.

5396

Wisconsin Univ.

ANGULAR DISTRIBUTION OF NEUTRONS SCATTERED BY HELIUM. (abstract) R. K. Adair. [nd] 1p. (AECU-1416)

The report is reproduced here in its entirety.

A proportional counter filled with helium was irradiated with monoenergetic fast neutrons produced by bombarding thin lithium targets and tritium-filled zirconium targets with protons from the electrostatic generator. Angular distributions of the neutrons scattered by helium were determined by measuring the distribution in energy of the pulses from the recoiling α particles with a differential discriminator. Measurements were made for eleven different neutron energies from 400 to 2730 kev. The scattering of neutrons and protons from α particles has been described (R. K. Adair, Phys. Rev. 82, 750-1, (1951)) in terms of a potential leading to a $P_{3/2} - P_{1/2}$ doublet in He^5, split by about 5 Mev, a description which is consistent with the neutron-α total cross section and the proton-α differential cross sections. Using the same assumptions, the differential cross sections for the scattering of neutrons by α particles was calculated and was found to be in qualitative agreement with the measured angular distributions.

5397

Wisconsin Univ.

CLASSIFICATION OF LEVELS IN N^{13}. (abstract) H. L. Jackson and A. I. Galonsky. [nd] 1p. (AECU-1420)

The report is reproduced here in its entirety.

Goldhaber and Williamson's data (Goldhaber and Williamson, Phys. Rev., in press) for elastic proton scattering from C^{12} has been investigated by partial wave analysis, using Laubenstein's (Ph.D. Thesis, University of Wisconsin, 1950) technique. The analysis indicates that the first resonance (0.484-Mev bombarding energy) is due to an $S_{1/2}$ level in N^{13} with excitation energy E_r = 2.348 Mev. The second resonance (1.73 Mev bombarding energy) results from a $P_{3/2}$ and a $D_{3/2}$ level with 3.478 and 3.525 Mev, respectively. The reduced widths of the $S_{1/2}$ and $D_{3/2}$ levels are comparable to the Wigner limit, but that of the $P_{3/2}$ level is much less. It is fairly certain that no other reasonable assignment explains the experimental data. Since the absolute cross section is in doubt to about ±30%, the interaction radius is somewhat arbitrary. Consequently, the numerical values of E_r and γ^2 may be slightly in error. However, to obtain a reasonable fit of the data, the interaction radius must be approximately $1.45(\sqrt[3]{A} + \sqrt[3]{1}) \times 10^{-13}$ cm. Below 1.0 Mev the experimental cross section is progressively less than that calculated. The discrepancy may result from a loss of detector efficiency at low energies.

5398

Argonne National Lab.

TOTAL NEUTRON CROSS SECTIONS OF COBALT, MANGANESE, AND MOLYBDENUM. Warren Fenton Stubbins. May 1951. 13p. (AECU-1441; UAE-397)

The total neutron cross sections of Co, Mn, and Mo were measured with a neutron energy resolution of ±6 kev using neutrons from Li(p,n)Be reaction with an electrostatic accelerator. Co and Mn were examined from 80 to 1000 kev. Both their cross sections fluctuate rapidly at low energies and level off and decrease slowly to about 3 barns at 750 kev. Mo was measured from 10 to 1230 kev, and its cross section is about 9 barns to 250 kev and decreases uniformly to 6 barns at 1230 kev. (auth)

5399

Wisconsin Univ.

THE ELASTIC SCATTERING OF PROTONS FROM Mg^{24}. F. P. Mooring, L. J. Koester, Jr., E. Goldberg, D. Saxon, and S. G. Kaufmann. [nd] 31p. (AECU-1540)

The differential scattering cross section has been determined for protons scattered elastically from Mg^{24} at a laboratory angle of 164 ± 5°. The targets consisted of thin $Mg^{24}F_2$ films evaporated onto thick graphite. Protons scattered elastically from Mg^{24} were selected by a 90° magnetic analyzer and were counted by a proportional counter. At least 9 anomalies occur in the cross section between 0.40 and 3.95 Mev, indicating the excitation of 9 levels of the compound nucleus, Al^{25}. At the higher energies the cross section rises, indicating the presence of a wide level above 3.95 Mev that reaches down to affect the scattering at lower energies. Experimental scattering cross sections as a function of energy are plotted on the same graph with theoretical values assuming Rutherford scattering. At most of the resonances, competing reaction cross sections have been shown to be relatively small. Only at the 2.42-Mev resonance was a low-energy proton group found that could be definitely attributed to the inelastic scattering of protons from Mg^{24}.

5400

Los Alamos Scientific Lab.

THE TRANSMISSION OF SLOW NEUTRONS BY LIQUID HELIUM. L. Goldstein, H. S. Sommers, Jr., L. D. P. King, and C. F. Hoffman. [nd] 8p. (AECU-1569)

In a study of the slow-neutron scattering properties of liquid He at a temperature of 1.7 to 4.0°K, the neutrons transmitted by a cylindrical double cryostat containing the liquid He surrounded, in the outer cryostat, by O_2 were detected by an enriched BF_3 gas neutron counter. The results of a typical run are graphed, transmission values and cross sections per liquid atom at 3.965°K being plotted as a function of energy of the incident neutron beam (expressed in units of degree K). Transmission increases from about 85% at the highest effective neutron energy (~380°K to unity at the lowest neutron energy (~20°K). This result is in line with what was expected on the basis of a rather general liquid model. The free-atom total scattering cross section of about 0.6 to 0.7 barn obtained is considerably smaller than most of those given in the literature.

5401

Columbia Univ.

SLOW NEUTRON VELOCITY SPECTROMETER STUDIES IV; Au, Ag, Br, Fe, Co, Ni, Zn. W. W. Havens, Jr., and L. J. Rainwater. Oct. 24, 1950. 52p. (CUD-59; DR-1552)

Improvements in the Columbia University spectrometer are discussed, including methods for the calibration of the over-all delay time and effective source-detector distance. The principal neutron resonance in Au has been redetermined as E_0 = 4.87 ± 0.07 ev, and in Ag as 5.13 ± 0.07 ev. Resonances are found in Br at 35.7, 54, 104, and 136 ev. Transmission dips are also observed at higher energies which are probably due to unresolved levels. The thermal cross section of Fe is well matched by the relation $\sigma = (11.2 + 0.33E^{-1/2})$ barns. Crystal interference effects are observed in the thermal region with the Debye-Scherrer rings at 2.3 A and 2.8 A resolved. The cutoff wavelength predicted to be at 4.04 A is in good agreement with experiment. No strong resonances are observed in Fe at high energies. Resonances are observed in Co at 126 and 5000

ev. Ni shows crystal interference effects in the thermal region; no strong resonances were detected at high energies. The thermal cross section of Zn is well matched by the relation $\sigma = (3.85 \pm 0.14E^{-\frac{1}{2}})$ barns with crystal interference effects observed in the thermal region. Resonances in Zn occur at 520, 1100, and 3800 ev. (auth)

5402

Los Alamos Scientific Lab.

A METHOD FOR EVALUATION OF MULTIPLE SCATTERING EFFECTS IN CHARGED PARTICLE EXPERIMENTS. W. C. Dickinson and D.C. Dodder. Dec. 1, 1950. 34p. (LA-1182)

The multiple scattering theory of E. J. Williams (Proc. Roy. Soc. 169, 531(1939); Phys. Rev. 58, 292(1940)) is reviewed. Consideration is taken of particle energy loss in the foil by use of the Bethe range-energy formula. All necessary formulas are given in convenient form for the computation of the mean square angle $\overline{\Theta_m^2}$ of multiple scattering in a foil. For protons, deuterons, and α particles, traversing Al foil, tables of computed values of $\overline{\Theta_m^2}$ are given. A graphical integration method is described for the easy determination of the fractional loss of particles due to multiple scattering in a foil. By use of this method an interesting reciprocity relation is shown to exist between the dimensions of the foil and of the detector. Finally, the results obtained, using Williams' theory and the graphical method, are compared with experimental determinations of multiple scattering effects. (auth)

5403

Nuclear Development Associates, Inc.

GAMMA-TRANSMISSION IN IRON, TUNGSTEN, LEAD, URANIUM, AND A PURE COMPTON SCATTERED BY ROOT-MEAN-SQUARE ANGLE CALCULATION. Leonard R. Solon, J. Ernest Wilkins, Jr., Alan Oppenheim, and Herbert Goldstein. Apr. 5, 1951. 55p. (NYO-637)

The root-mean-square angle technique is extended to the calculation of buildup factors in Fe, W, Pb, and U for 1- to 8-Mev photons and in a pure Compton scatterer for 1, 2, 5, and 10 mc^2 photons, the buildup factor being the ratio of secondary, degraded photons to primaries. Computations are carried out to 20 mean free paths for the metals and 40 mean free paths for the Compton scatterer. The behavior of the buildup factors as functions of the initial energy for the heavy elements is found to differ qualitatively from that for Fe and the pure Compton scatterer. 44 tables. 17 graphs. (auth)

5404

Palmer Physical Lab., Princeton Univ.

MULTIPLE SCATTERING OF HIGH ENERGY CHARGED PARTICLES IN THIN FOILS. T. Teichmann. May 1, 1951. 16p. (NYO-785)

An approximate expression for multiple scattering is derived as the sum of two types of terms—those due to "pure" multiple scattering, i.e., to many deflections through small angles, and those due to multiple scattering superposed on single- (or double-, etc.) deflection through a large angle.

5405

Rochester Univ.

A SEARCH FOR CHARGE EXCHANGE SCATTERING OF π^+ MESONS. Richard Wilson and John P. Perry. Aug. 6, 1951. 5p. (NYO-902)

A direct search has been made for charge-exchange scattering of 44-Mev π^+ mesons by Be and D_2O. Scintillation crystals counted the incident π^+ mesons, and scintillation-counter telescopes counted pairs of γ rays from π^0 decay. The results indicate that upper limits on the cross section for charge-exchange scattering may reasonably be set at 2 mb for Be, 3 mb for D, and 6 mb for O. The low upper limit found for the charge-exchange cross section in Be for 44-Mev π^+ mesons is compared with the total scattering cross section (direct plus charge exchange) of 13.3 mb which Chedester et al. (Phys. Rev. 82, 958(1951)) found for 85-Mev π^- mesons on protons. This implies that the chief contribution to the 13.3 mb comes from direct scattering unless the charge-exchange cross section increases rapidly with energy.

5406

Palmer Physical Lab., Princeton Univ.

THE NUCLEAR SCATTERING OF 1 MEV ELECTRONS AND POSITRONS. Harry J. Lipkin. June 15, 1951. 26p. (NYO-970)

The scattering of 1-Mev electrons and positrons by thin foils has been investigated from two points of view: (1) to compare the cross section for elastic nuclear scattering of positrons with that of electrons, and (2) to look for evidence of inelastically scattered electrons which have suffered large energy losses. Electrons and positrons from artificially radioactive sources were energy-selected by a solenoidal spectrometer before being scattered by various foils. After being scattered, the particles entered a second (analyzer) magnetic field and were then detected by a Geiger counter. To study inelastic scattering of electrons the analyzer field was varied. To study the e^-/e^+ scattering ratio, various scatters could be employed without changing the equipment in any way except to replace the electron source by a positron source. Thus the e^-/e^+ scattering ratio could be measured with greater accuracy than the scattering of either particle separately. The observed e^-/e^+ scattering ratio ranging from 2 to 3 is consistent with a rather rough theory which does not take screening into account. No inelastic scattering was found in foils of Cu, Al, or Pt. (auth)

5407

Palmer Physical Lab., Princeton Univ.

THE SCATTERING OF 32-MEV PROTONS FROM SEVERAL ELEMENTS. Roy Britten. June 22, 1951. 91p. (NYO-971)

The elastic and inelastic scattering of 32-Mev protons from the Berkeley linear accelerator from Be, C, Al, Pb, and Pt has been observed, using a NaI(Tl) crystal and photomultiplier for particle detection and energy measurement. Inelastic scattering has been observed, leading to the excitation of states or closely spaced groups of states at 2.3, 6.8, and 11.6 Mev in Be; 4.3, 7.5(?), and 9.5 Mev in C; and a group of states between 11 and 17 Mev in C. Deuterons have been observed from the reaction $C^{12}(p,d)C^{11}$, leading to the ground state of C^{11}. The differential cross sections for the elastic scattering of 32-Mev protons have been measured at several angles for Be^9, C^{12}, Al^{27}, and Pb. A comparison with the results of calculations based on several different nuclear models is made. (auth)

5408

Oak Ridge National Lab.

DETECTION POSSIBILITY OF CIRCULAR POLARIZATION OF GAMMA RAYS. D. B. Beard and M. E. Rose. Aug. 13, 1951. 11p. (ORNL-1072)

In order to obtain information about the angular momenta involved in transitions in which polarized incident neutrons give rise to polarized γ rays, it is necessary to be able to detect the polarization of circularly polarized γ rays. If the aligned electrons in magnetically saturated Fe are used to determine the polarization of the emitted γ rays the average spin (in units $\hbar$) of the Fe electrons along the axis of magnetization is only ~ 0.04. Unless the anisotropy in the Compton scattering is quite large, therefore, such an experimental determination of the polarization correlation of neutrons and γ rays will not be possible. In the hope that an appreciably larger factor might arise in the Compton scattering anisotropy, the Compton scattering of circularly polarized light is computed in this report. Using magnetized

Fe the maximum observable anisotropy in the Compton scattering of circularly polarized photons is at best only 1%.

5409

Radiation Lab., Univ. of Calif.

PHYSICS DIVISION QUARTERLY REPORT; NOVEMBER, DECEMBER, 1950, AND JANUARY 1951. Mar. 20, 1951. 69p. (UCRL-1191)

The scattering of high-energy deuterons by 90-Mev neutrons is shown to be divided between inelastic and elastic events in a way predictable by the theory developed by G. F. Chew and others. The elastic collisions show a sharp forward peak due to the pickup of a proton by the incoming deuteron. The protons fall into two groups, high-energy protons in the forward direction and low-energy protons which tend to be spherically symmetric. The forward peak of protons is weaker at small angles than would be explainable on the basis of n-p scattering alone. This is explained by the application of the Pauli principle to the two remaining neutrons. An investigation of the large-angle scattering and stars produced by fast π^- mesons in nuclear emulsion has shown eleven scatters of total angle greater than 90° and 11 stars observed in a total length of 902 ± 30.4 cm of π^- meson track. It appears that the total cross section for nuclear interaction of 30- to 40-Mev π^- mesons in emulsion is equal to nuclear area. Results are discussed of a study of the grain density of nuclear emulsion tracks as a function of the pertinent variables. The energy spectrum of positrons from μ^+ meson decay has been studied with a technique of large-solid-angle focusing obtained with an axially symmetric heterogeneous magnetic field. Results obtained have shown that the maximum positron energy is close to 56 Mev with the intensity maximum ~ 40 Mev. Energy spectra of 340-Mev protons have been obtained at 8½, 10½, 13, 15, and 17° using targets of H, C, Al, Cu, and Pb, and at 41½° using C as target. The spectra from all of the targets except those from H have widths which increase monotonically with scattering angle. The measurement of proton energy by Cherenkov radiation is described in detail as obtained through the use of an improved optical system. A multiunit γ-pair detector is described in which photons from π^0 decay in the target strike a converter in which electron pairs are formed and then scattered through wide enough angles to be detected in adjacent counters. An experiment on the scattering of π^+ mesons by C has yielded a result for the differential scattering cross section of 90° of (2.2 ± 1.0) 10^{-26} cm^2 $steradian^{-1}$. The π^+ production by p-p interaction at 0° has yielded as an incidental result of the cross-section determination a value of the π^+ meson mass of 275.1 ± 2.5 electron masses. The cross section for the reaction $p + p \rightarrow \pi^+ + d$ is determined to be $(1.30 \pm 0.26)10^{-28}$ cm^2 $ster^{-1}$. The π^+ production by p-p interaction at 60° has yielded a value for the total production cross section at 60° of (0.08 ± 0.04) 10^{-28} cm^2 $ster^{-1}$.

5410

Radiation Lab., Univ. of Calif.

ELASTIC D-P SCATTERING AT 190 MEV. Martin O. Stern and Arnold L. Bloom. Apr. 5, 1951. 5p. (UCRL-1209)

Measurements are being made of the elastic scattering on protons of the 190-Mev deuterons from the Berkeley 184-in. cyclotron. Deuterons scattered out of the cyclotron are collimated and made to impinge on a target, carbon and polyethylene being used alternately to obtain the scattering cross section by subtraction. Coincidences between protons and deuterons are observed by means of stilbene crystals. A plot of the differential scattering cross section vs. the angle of deflection in the center-of-mass system summarizes results so far obtained. The points fit the theoretical curve of Chew (Phys. Rev. 74, 809(1948)) from 60 to 110°, but at larger angles the measured cross section is lower than Chew's. (This entire report appeared as a letter to the editor in Phys. Rev. 83, 178(1951) July 1.)

5411

Radiation Lab., Univ. of Calif.

PROTON-PROTON SCATTERING NEAR 30 MEV. Franklin L. Fillmore. Apr. 16, 1951. 7p. (UCRL-1234)

Experiments on the scattering of protons (linear accelerator beam) by H_2 gas, as measured by the photographic method, have been continued. The procedure and calculations are the same as those reported in Phys. Rev. 79, 57(1950) (see also NSA 4-3203) with a few improvements in technique. Two background runs were made, one with the scattering chamber evacuated and the other like a scattering run except that scattered protons were prevented from reaching the plates. The third run was a scattering run. Results of the three runs are tabulated. The number of scattered protons should be symmetric about 45° in the laboratory system. Tabulated data show that this is so, particularly at low-scattering angles. The mean range at 45° was found to be 1120 ± 4.3 μ, corresponding to an energy of 30.14 ± 0.08 Mev before scattering. Cross sections are plotted as a function of angle.

5412

Radiation Lab., Univ. of Calif.

SCATTERING OF π MESONS BY DEUTERIUM. S. Fernbach, T. A. Green, and K. M. Watson. Apr. 17, 1951. 7p. (UCRL-1242)

For sufficiently high meson energies the impulse approximation (G. F. Chew, Phys. Rev. 80, 196(1950)) may be used to express the scattering cross section for deuterium in terms of the free particle cross sections for protons and neutrons. This calculation is discussed and compared with another expression, called the closure approximation, which can be used under certain experimental conditions so that the meson-neutron cross section may be estimated without a knowledge of the phase factor. (The entire report was published as a letter to the editor in Phys. Rev. 82, 980 (1951) June 15.)

5413

California Univ., Berkeley

PHOTONUCLEAR STARS IN EMULSIONS. (dissertation) Richard Dean Miller. [nd] 37p. (UCRL-1320)

Ilford type C-2 nuclear research emulsions were exposed in the x-ray beam from the Berkeley synchrotron at four synchrotron energies. The relative yields of the photoproduced nuclear stars were determined as a function of synchrotron energy and prong number. A separation of the three and more prong stars into those produced from the light elements and those from the heavy elements in the emulsion was made. The resultant yields are expressed in terms of the cross sections of carbon and of Ag, integrated over the bremsstrahlung spectrum, and also as cross sections averaged over the 80-Mev energy intervals between the synchrotron energies. These results are compared with the predictions of two different mechanisms for the photodisintegration process at high energy, and it is concluded that the present data favor the process of meson production and reabsorption as the primary process at high energies, but does not exclude appreciable yields from other processes. (auth)

5414

Radiation Lab., Univ. of Calif.

ELASTIC SCATTERING OF 340-MEV PROTONS. (thesis) Robert E. Richardson. July 26, 1951. 64p. (UCRL-1408)

Elastic scattering of 340-Mev protons by C, Bi, Al, Cu, Ag, Pb, Ta, W, S, Si, and Mg targets has been studied. The data for the angular distributions for the elements measured are tabulated and plotted. The differential elastic-scattering cross section is shown as a function of the angle of scat-

tering. The positions of the maxima and minima of the measured diffraction patterns are plotted as a function of atomic mass number. The total cross sections for "nuclear" elastic scattering are tabulated.

5415
Radiation Lab., Univ. of Calif.
THE INELASTIC SCATTERING OF PROTONS FROM CARBON. (dissertation) Peter Adalbert Wolff. July 1951. 39p. (UCRL-1410)

The spectrum of high-energy protons that have been inelastically scattered from carbon is given a mathematical treatment. It is shown that this spectrum depends in a rather direct way upon the momentum distribution of particles within the target nucleus. To illustrate the method a simple problem, that of scattering from a harmonically bound particle, is solved first. This calculation embodies many of the important features of scattering from the carbon nucleus and, in addition, possesses the advantage of being soluble directly (at least in Born approximation) since the harmonic oscillator wave functions and matrix elements are known. The second part of the paper deals with the more complicated problem of scattering from the nucleus. The method illustrated before is used to obtain formulas for the energy spectra of protons scattered at various angles from carbon. Finally, by making various assumptions about the momentum distribution in the nucleus, an attempt is made to fit what experimental data is available, thereby testing the theory and also providing some information as to which momentum distribution is most acceptable.

5416
Atomic Energy Research Establishment, Harwell, Berks. (England)
RANGE-ENERGY AND RANGE MOMENTUM RELATIONSHIPS FOR CHARGED PARTICLES. [Bibliography] Feb. 1951. 27p. (AERE-Inf/Bib.-71)

5417
INVESTIGATION OF THE SCATTERING OF POSITRONS ON ELECTRONS IN THE WILSON CLOUD CHAMBER. O. Ritter, C. Liesenberg, H. Maier-Leibnitz, A. Papkow, K. Schmeiser, and W. Bothe. Z. Naturforsch 6a, 243-9 (1951) May. (In German)

In a specially constructed "slowly-expanding" cloud chamber, the scattering of positrons from Cu^{64} on electrons was observed. From the examination of a total of 2900 m of positron tracks on 5000 photographs, the distribution of collisions according to the amount of energy transferred was determined. Within experimental errors, the results agree with the theory of Möller (Ann. Physik 14, 531(1932)) and Bhabha (Proc. Roy. Soc. (London) 154A, 195(1936)). In one case a collision between a positron and two electrons was observed. (auth)

5418
A METHOD FOR THE DETERMINATION OF AIR EQUIVALENTS OF FOILS FOR α RAYS. Fritz Hawliczek. Sitzber. Akad. Wiss. Wien, Math.-naturw. Klasse. Abt. IIa 155, 167-77(1947). (In German)

A simple and rapid method for the determination of air equivalents of foils for α rays is proposed, involving the use of an electrometer tube with a low time constant. Accuracy to within 0.01 mm can be obtained. Among the advantages of the method is the possibility of using weakly radioactive sources. (auth)

RADIATION EFFECTS

5419
Oak Ridge National Lab.
PHYSICAL PROPERTIES OF IRRADIATED PLASTICS. O. Sisman and C. D. Bopp. June 29, 1951. 226p. (ORNL-928)

A series of graphs and charts are presented depicting quantitatively the changes in physical properties which various plastics undergo when subjected to radiation in the ORNL reactor. Tests were made of the following properties: tensile properties, shear strength, impact strength, Rockwell hardness, change in weight, specific gravity, water absorption, light transmission and haze, volume resistivity, dielectric strength, and arc resistance. Certain mineral-filled phenolics and styrene polymers withstood a dose of 10 10^{19} nvt with little change in properties. Cellulosic, casein, acrylic, and chlorofluoroethylene plastics decrease 50% in tensile strength at 10^{17} nvt. Plastics of intermediate resistance in order of resistance are: polyvinyl carbazole, aniline formaldehyde, polyethylene, nylon, polyester, organic-filled phenolic, melamine, urea, unfilled phenolics, polyvinyl-vinylidene chloride, and polyvinyl chloride acetate. (auth)

RADIOACTIVITY

5420
Los Alamos Scientific Lab.
INVESTIGATION OF FISSION GAMMA RAYS. M. Deutsch. and H. Rotblat. Nov. 13, 1944. 22p. (AECD-3179; LADC-910)

Emission of γ rays accompanying the fission process of U^{235} was investigated by the coincidence method. Details of the fission chamber, counters, and circuit are given. It was found that the total energy of the γ rays is 5.1 Mev per fission and that the individual quanta have an average energy of about 1 Mev. No delayed γ rays have been observed.

5421
Argonne National Lab.
RADIATIONS ASSOCIATED WITH THE TRANSITION $Pu^{238} \rightarrow U^{234}$. George W. Reed, Jr. Jan. 24, 1951. Decl. July 3, 1951. 12p. (AECD-3185; ANL-WMM-837)

Radiations, other than the primary α radiation, associated with the transition $Pu^{238} \xrightarrow{\alpha} U^{234}$ have been studied. Results indicate electromagnetic components of about 13, 18, and 42 kev; the yields of these radiations per 1000 α disintegrations were found to be approximately 60, 110, and 4, respectively. There is also evidence for softer x rays (probably uranium M x rays), a γ of the order of ~170 kev, and a soft conversion electron. Absorption curves are shown as obtained using Pb, Cu, and Al absorbers. To obtain information on the soft components, a standard end-window Geiger-counter tube was inserted between the pole pieces of an electromagnet and the effect on the counting rate was noted as the magnetic field was increased. There is evidence for a soft deflectable component as may be seen in a plot.

5422
Argonne National Lab.
THE SPECIFIC ALPHA RADIOACTIVITY OF Pu^{240}. Edgar F. Westrum, Jr. [nd] 3p. (AECD-3197) Decl. July 9, 1951.

The half life of Pu^{240} has been calculated by comparing the specific α activity of Pu^{239} with the observed activities of the Pu fractions of several samples subjected to different neutron fluxes. The isotopic compositions of the samples were available from the mass-spectrometric examinations of Bartlett and Swinehart (LA-561(1946)). The best value of the Pu^{240} half life is 6240 ± 120 yr.

5423
Brookhaven National Lab.
CROSS OVER TRANSITION IN THE DECAY OF Tc^{99m}. J. W. Mihelich, M. Goldhaber, and Elizabeth Wilson. Apr. 19, 1951. 5p. (AECU-1386)

5424
Brookhaven National Lab.
THE BETA-RAY SPECTRUM OF Tl^{206}. D. E. Alburger and G. Friedlander. Apr. 17, 1951. 4p. (AECU-1410)

Samples of pure thallium metal were irradiated in the Brookhaven nuclear reactor, and a beta activity of 4.3 ± 0.1-min half life was observed. A search for γ radiation from strong sources was made with a scintillation spectrometer by photographing the pulse-height distribution presented on an oscilloscope screen. These photographs revealed no γ-ray structure other than a continuum of energies mostly below 500 kev which can be accounted for only as bremsstrahlung from the β rays. A lens spectrometer set for 3% resolution was used to study in detail the electron spectrum from evaporated foils of Tl metal approximately 2 mg/cm² thick. In a search for γ rays no internal conversion lines were found. The Kurie plot of the beta-spectrum is shown. The plot is linear above about 0.5 Mev and has an end point at 1.51 ± 0.01 Mev. The deviation from linearity is about what one would expect from the source thickness and does not contradict the conclusion that the spectrum is simple and of the allowed type.

5425

Argonne National Lab. and Chicago Univ.

THE INTERPRETATION OF ISOMERIC TRANSITIONS. Steven A. Moszkowski. May 1951. 7p. (AECU-1414; UAC-392)

An abstract of this report was indexed as AECU-1263 and appeared in Nuclear Science Abstracts as NSA 5-3547.

5426

Brookhaven National Lab.

TWO-STEP ISOMERIC TRANSITION IN Sn^{119m} (250 d). G. Scharff-Goldhaber, E. der Mateosian, M. Goldhaber, G. W. Johnson, and M. McKeown. June 4, 1951. 6p. (AECU-1426)

Since the highly converted 65.8 ± 0.25-kev isomeric transition in Sn^{119m} is probably the magnetic 2^4-pole transition $h_{11/2} \rightarrow d_{3/2}$ and since the ground state of Sn^{119} is $s_{1/2}$, this transition should be followed by a magnetic dipole transition. When a search with both scintillation and proportional counters failed to reveal a new γ ray, an "impregnated" crystal technique was evolved to permit observation of the sum of 2 or more γ transitions if they follow each other in $\lesssim 1$ μ sec. An oscilloscope trace corresponding to a value of 85 ± 4 kev for the total transition energy was found. A disintegration scheme (65.8 ± 0.25 kev γ ray followed by a 20 ± 5 kev γ) is proposed for Sn^{119m}. It is suggested from observations of two-step isomeric transitions in Te^{121}, Te^{123}, Te^{125}, Sn^{117}, and Sn^{119} that the $d_{3/2}$ levels move toward the $s_{1/2}$ levels with rising A and eventually cross over.

5427

Rochester Univ.

A REDUCTION OF ARBITRARINESS IN THE THEORY OF FORBIDDEN β-SPECTRA. C. L. Longmire and A. M. L. Messiah. [nd] 5p. (AECU-1450)

Reduction of arbitrariness has been achieved in the theory of forbidden β spectra making the study of such spectra more useful as a test of β-decay theory. Present experimental evidence gives some reason to believe that nuclei respect the requirement of invariance with respect to time reversal. Conversely, results of the author lend credence to the manner in which these forbidden spectra have been fitted.

5428

Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.

ISOMERIC STATE OF Y^{89} AND THE DECAY OF Zr^{89}. M. Goldhaber, E. der Mateosian, G. Scharff-Goldhaber, A. W. Sunyar, M. Deutsch, and N. S. Wall. [nd] 4p. (AECU-1474)

The production of Y^{89m} by excitation with fast neutrons has been demonstrated in a very pure Cd-covered sample of Y_2O_3 exposed to fast neutrons from the Brookhaven reactor. A strong 0.92-Mev γ-ray activity with a half life of 16 ± 3 sec was found. An activity with γ rays of the same energy and a half life of 13 ± 2 sec was extracted from Zr^{89}, which showed a 0.91-Mev γ ray and 0.51-Mev annihilation radiation. A careful search failed to produce any evidence for other γ rays ascribed to Zr^{89} by Hyde and O'Kelley (UCRL-1064, NSA 5-2615). About 1.3 times as many nuclear γ rays as x rays, and about 4 times as many γ rays as positrons were found in Zr^{89} decay. The corresponding total conversion coefficient is in good agreement with the theoretical value for a magnetic 2^4-pole transition, the most energetic yet identified, in Y^{89}. The author gives the value 14 ± 2 sec, possibly a weighted average, for the half life of the Y^{89} isomeric transition.

5429

Knolls Atomic Power Lab.

HALF LIVES OF Cu^{66}, Cu^{64}, Fe^{59}, and Ce^{144}. Robert P. Schuman and Anita Camilli. [nd]. 2p. (AECU-1514)

The report is reproduced here in its entirety.

In the course of our work, the half lives of Cu^{66}, Cu^{64}, Fe^{59}, and Ce^{144} have been determined with considerable precision. The half lives of the copper isotopes were determined on samples of electrolytic copper foil irradiated with water moderated radium beryllium neutrons. The Fe^{59} sample was from a cyclotron irradiation unit, free of Fe^{55}, obtained through the isotopes division of the Atomic Energy Commission. The Ce^{144} sample was obtained by the radiochemical isolation of cerium from fission products after a decay of more than 1 yr so that the sample would be free of Ce^{141}. The counting has been done with a flow proportional counter (Nucleometer) using an external sample counter. All counts were checked against a standard to insure a constant counting efficiency.

We have obtained a half life of 5.12 ± 0.05 min for Cu^{66}, in good agreement with the values of 5.18 ± 0.10 min by Cameron and Katz (Phys. Rev. 80, 904, (1950)), and 5.05 min by Meitner (Arkiv Mat. Astron. Fysik, 33A No. 3 (1946)), but differing from the value of 4.34 ± 0.03 min by Silver (Phys. Rev. 76, 589, (1949)). An irradiation was made of a Cd shielded Cu foil which showed that most of the activation was due to thermal neutrons; the Cd shielded Cu foil also showed a 5-min half life. Our value for the Cu^{64} half life is 12.74 ± 0.07 hr, in agreement with the present literature. ("Nuclear Data," N.B.S. Circular, 499).

Our value for the half life of Fe^{59} is 45.1 ± 0.2 days. The decay of the sample has been followed for eight half lives, and does not show any tendency to tail out into a longer half life. The Ce^{144} sample has been followed for two half lives, and shows a half life of 282 ± 3 days. Our half life for Fe^{59} is slightly lower than the published values of 45.5d as reported by Govaerts (Bull. Soc. Roy. Sci. Liége, 12, 555, (1943)) and 46.3 d as reported by Swartout (Nuclear Data, NBS Circular 499). The half life of Ce^{144} is in general agreement with the literature values of 275, 290, and 310 days.

We have also followed samples of Fe^{55} and Pm^{147} for a period of 1 yr. The Fe^{55} sample was obtained through the isotopes division of the Atomic Energy Commission, and the Pm^{147} sample was radiochemically isolated from fission products. Both samples were shown to be radiochemically pure by absorption curves. The preliminary value of the Fe^{55} half life is 3.0 ± 0.15 yr, in good agreement with the better value of 2.94 yr reported by Brownell and Meletskos (Phys. Rev., 80, 1102 (1950)). The Pm^{147} half life is 2.6 ± 0.2 years, compared with literature values of 2.26 yr reported by Inghram, Hayden, and Hess (Phys. Rev., 79, 271, (1950)) and 3.7 yr reported by Swartout (op. cit.). ("Nuclear Data," N.B.S. Circular 499).

5430
Arkansas Univ.
INVESTIGATION OF THE SHAPE OF BETA-SPECTRA AT THE LOW-ENERGY END. R. R. Edwards, P. E. Damon, and H. M. Schwartz. [nd] 4p. (AECU-1537)

An investigation of the low-energy (< ~ 20 kev) end of the β spectrum by proportional counting of gaseous sources has been started. Of special interest are the screening and Coulomb effects and the disposition of excess atomic-electron binding energy resulting from the increased Z. Qualifications of suitable nuclides for investigation are listed. Investigations of the bond-rupture in Pb tetramethyl accompanying RaD (Pb^{210}) decay have been under way for some time, and since information on conversion coefficients as well as on excess binding energy is required for interpretation of results, initial studies are being made with this nuclide. At the Feb. 3, 1951, meeting of the American Physical Society, slides were shown of the apparatus and data, but no figures are included in this report, These data, together with measurements of the growth of RaE (Bi^{210}), constitute a strong indication of an isomeric state in RaE with a lifetime of greater than 5 to 10 μsec associated with about 60% of the RaD decays, perhaps involving the 47-kev state, implying a complex β spectrum for RaD.

5431
Argonne National Lab.
BETA-INNER BREMSSTRAHLUNG ANGULAR CORRELATION. T. B. Novey. July 1951. 5p. (AECU-1554; UAC-414)

Angular correlation between β radiation and inner bremsstrahlung was found in excellent agreement with theory. A P^{32} source, β detector (stilbene crystal and photomultiplier), and enclosing vacuum chamber were rotated as a unit relative to a γ detector (NaI(Tl) crystal and photomultiplier).

The theories predict γ emission predominantly in the direction of electron emission. The theoretical angular distribution is not sensitive to the nature of the interaction process in β decay.

5432
Argonne National Lab.
A CLARIFICATION OF THE RADIOACTIVITY OF Nd^{151} AND Pm^{151}. (abstract) W. C. Rutledge, J. M. Cork, and S. B. Burson. Aug. 1951. 1p. (AECU-1572)

The report is reproduced here in its entirety.

Enriched Nd^{150} was activated in the Argonne reactor. The internal conversion electrons and photoelectrons from a lead radiator were investigated in a permanent-magnet-type beta-spectrograph. Gamma-rays of 85.4 and 117.1 kev, decaying with a half life of 12 min, show work-function differences of promethium. Apparently they follow emission of the 1.93-Mev β-ray, which is thus assigned to Nd^{151}. Absorption measurements show promethium K-x-ray and another γ-ray of 895 kev. This 12-min activity proves to be the parent of a 27.5-hr β-ray of 1.1 Mev in Pm^{151}. (This is the usual case where the half lives of members of a chain with odd mass numbers increase successively down the chain.) Associated γ-rays of 64.7, 65.8, 69.6, 99.9, 116.2, 105.0 (or 144.0), 163.1, 168.0, 177.0, 208.3, 231.9, 239.9, 275.2, and 340.1 kev are characterized by Sm work-function differences. Absorption measurements also show a weak 615-kev γ-ray. These data and coincidence measurements make it possible to propose a decay scheme.

5433
Argonne National Lab.
INTERNAL CONVERSION OF NEUTRON CAPTURE GAMMA-RAYS. C. T. Hibdon and C. O. Muehlhause. Aug. 1951. 8p. (AECU-1578; UAC-425)

Prompt-internal conversion electron lines resulting from neutron capture in Gd^{odd} Sm^{149} and Cd^{113} have been observed. Their energies were measured in a 180° focusing, constant magnetic field, film recording β-ray spectrograph. The spectrograph was placed in a neutron beam from the Argonne heavy water reactor in such a way that the source underwent bombardment during recording. In some cases K, L, and M lines were observed. Each element exhibited two strongly converting capture γ-rays from a single isotope. (auth)

5434
Iowa State Coll.
TANTALUM ACTIVITIES PRODUCED BY PHOTONUCLEAR REACTIONS ON TUNGSTEN. Alfred J. Moses and Don S. Martin, Jr. Aug. 20, 1951. 4p. (AECU-1579)

Samples of $Na_2WO_4.2H_2O$ were irradiated in a synchrotron-produced beam of x rays, with maximum energies of 30 and 68 Mev, for 1 to 4 hr. Three Ta activities were observed as follows: a 48-min 1.6-Mev β^- assigned to Ta^{185}, accompanied by a 0.15-Mev e^- due to branching β decay in Ta^{185} or to an isomeric transition in W^{185}; a 6.0-day 0.6-Mev β^- tentatively assigned to Ta^{183}; and an 8.0-hr 0.7-Mev β^- (and x rays) assigned to Ta^{180}.

5435
Argonne National Lab.
NUCLEAR SHELL STRUCTURE AND β-DECAY; I. ODD A NUCLEI; II. EVEN A NUCLEI. M. G. Mayer, S. A. Moszkowski, and L. W. Nordheim. May 1951. 48p. (ANL-4626)

In part I a systematics is given of all transitions for odd-A nuclei for which sufficiently reliable data are available. The allowed or forbidden characters of the transitions are correlated with the positions of the initial and final odd nucleon groups in the nuclear shell scheme. The nuclear shells show definite characteristics with respect to parity of the ground states. The latter is the same as the one obtained from known spins and magnetic moments in a one-particle interpretation. In part II a systematics of the β transitions of even-A nuclei is given. An interpretation of the character of the transitions in terms of nuclear shell structure is achieved on the hypothesis that the odd nucleon groups have the same structure as in odd-A nuclei, together with a simple coupling rule between the neutron and proton groups in odd-odd nuclei. (auth)

5436
Pupin Physics Labs., Columbia Univ.
RADIOACTIVITY OF F^{17}. V. Perez-Mendez and P. Lindenfeld. June 15, 1951. 1p. (CU-95; DR-1670)

This report is reproduced here in its entirety.

The gamma radiation from F^{17} has been reexamined with a scintillation counter and a pulse height analyzer.

Distilled water was bombarded with deuterons in the internal beam of the 36 in. cyclotron and half lives were measured at different pulse height settings. With the increased activity which was produced in this way, and the better energy discrimination, it was found that the previously reported gamma rays (Perez-Mendez and Lindenfeld, Phys. Rev. 80, 1097 (1950)) of energy higher than that of annihilation radiation had a half life distinctly shorter than that of F^{17}.

The large chemical activity of fluorine and of the ozone which is produced when gaseous oxygen is bombarded makes it likely that some impurity was carried along in the previous experiments.

We conclude that F^{17}, in common with other mirror image nuclei which have been investigated with spectrometers, does not emit any nuclear gamma radiation.

5437
Pupin Physics Lab., Columbia Univ.
BETA SPECTRUM OF Cl^{36}. C. S. Wu and L. Feldman. Feb. 19, 1951. 6p. (CUD-66); DR-1588)

The fitting of the experimental spectrum of Cl^{36} from about 200 to 716 kev with theoretical factor C_{2T} has now been accomplished with an appropriate choice of the ratio of nuclear matrix elements. (See also NSA-3-1742)

5438

Oak Ridge National Lab.

K-SHELL INTERNAL CONVERSION COEFFICIENTS; REVISED TABLES. M. E. Rose, G. H. Goertzel, and C. L. Perry. June 25, 1951. 58p. (ORNL-1023)

Tables of the K-shell conversion coefficients are presented to replace tables previously issued by Rose et al. The range of Z and γ-ray energy ($k\,mc^2$) is the same as before ($10 \leq Z \leq 96$; $0.3 \leq k \leq 5.0$), and values are given for α_l and β_l (electric and magnetic 2^l -pole conversion coefficients, respectively) for $l = 1, 2, 3, 4, 5$. The interpolation has been extended to low Z values, and errors have been corrected. In the tables the 680 key values calculated on the Automatic Sequence Relay Calculator are given to four significant figures and the interpolated values are given to three. In addition, the 26 figures appended give the conversion coefficients on a log scale vs. k, also on a log scale, for each Z and each multipole.

5439

Columbia Univ.

UNITS OF RADIOACTIVITY AND RADIATION, paper 4 of HEALTH PHYSICS INSURANCE SEMINAR; [FEBRUARY 6–10, 1950]. G. Failla. Mar. 12, 1951. 4p. (TID-388(paper 4))

A simplified description of radioactive decay and units used in its measurement is presented in terms understandable by the layman.

5440

Brookhaven National Lab.

QUANTITATIVE SUMMARY OF NATURAL, X-RAY AND OTHER COMMON RADIATION LEVELS, paper 5 of HEALTH PHYSICS INSURANCE SEMINAR; [FEBRUARY 6–10, 1950]. F. P. Cowan. Mar. 12, 1951. 6p. (TID-388(paper 5))

The ubiquitous nature of background radiation, its relation to temperature inversion in the atmosphere and to rainfall, and the amount of radioactivity in soil, water, oceans, and that due to cosmic rays are reviewed briefly. Total background at Brookhaven National Laboratory is stated to be about 0.25 mr/day. Exposures received in various diagnostic x-ray examinations are listed.

5441

NEW ALPHA-RADIOACTIVE ISOTOPES. A. H. Wapstra. Nederland. Tijdschr. Natuurk. 17, 159-73(1951) May. (In Dutch)

The requirements of the theory of α decay are compared with data on recently discovered α-radioactive isotopes, mostly from the Np series.

RARE EARTHS AND RARE EARTH COMPOUNDS

5442

INVESTIGATION OF PHOTOLUMINESCENCE OF BENZOYLACETONATES OF EUROPIUM AND SAMARIUM. A. N. Sevchenko and A. K. Trofimov. Zhur. Eksptl'. i Teoret. Fiz 21, 220-9(1951) Feb. (In Russian)

A study was made of absorption and luminescence spectra of solutions of $Eu(C_6H_5COCHCOCH_3)_3$ and $Sm(C_6H_5COCHCOCH_3)_3$, (each molecule containing rings $Me(\ldots O = C-CH = C-O-)$), and of luminescence spectra of these compounds in the solid state. While absorption spectra present no discrete structure, photoluminescence spectra, of a discrete type characteristic of rare earths, vary with the temperature and the nature of the solvent. It can be surmised that the excitation energy, after being absorbed by the organic part of the molecule, is transmitted to the rare-earth atom where it is transformed into a discrete-line luminescence emission. Solutions of the europium compound were used for observations on the decay and the quenching of luminescence; the reduction of the quantum yield is accompanied by a simultaneous decrease of the decay constant. A polarization of the luminescence of the europium-compound solutions was detected and measured. (auth)

SPECTROSCOPY

5443

National Bureau of Standards and Argonne National Lab.

SOME SPECTRA OF ACTINIUM. Wm. F. Meggers, Mark Fred, and F. S. Tomkins. July 1951. 1p. (AECU-1562) (UAC-418)

The report is reproduced here in its entirety.

One milligram of Ac^{227} (prepared by transmutation of Ra^{226}) was placed in an aluminum hollow cathode and excited by argon ions. The emission spectra were photographed with a concave grating of 21-ft radius. Supplementary spectrograms were made with high-voltage condensed sparks between copper electrodes bearing 4 to 70 μg of Ac. In the range 2300 to 8800 A the wavelengths and relative intensities of more than 1000 spectral lines characteristic of actinium atoms, ions, and compounds have been determined. The most intense Ac I lines have wavelengths 4179.98, 4183.12, 6359.87, 6691.26 A, the most intense Ac II lines 3863.11, 4088.43, 4168.40, 5910.87 A, and the most intense Ac III lines 3392.77, 3467.60 A. A progression of bands observed between 5718 and 5780 A is believed to belong to AcO molecules. The ground state of Ac I is $6d\,7s^2\,{}^2D_{1\frac{1}{2},\,2\frac{1}{2}}$ with an interval of 2231.4 cm^{-1}. The ground state of Ac II is $7s^2\,{}^1S_0$ and the metastable terms $6d\,7s\,{}^3D_{1,2,3}$, $^1D_2$, $6d^2\,{}^3F_{2,3,4}$, $^1D_2$, $^1G_4$ have been positively established. Comparison of the homologous spectra shows that Ac II resembles Y II more closely than either Sc II or La II.

5444

Argonne National Lab. and National Bureau of Standards

NUCLEAR SPIN OF Ac^{227}. F. S. Tomkins, Mark Fred, and William F. Meggers. July 1951. 1p. (AECU-1563; UAC-419)

The report is reproduced here in its entirety.

As part of a joint investigation of the actinium spectrum interferometer exposures were made which yielded about 15 lines showing well-resolved hyperfine structure. The structure was in the form of flag patterns with either three or four components, with large degradation of spacing and intensity indicating a low nuclear spin. Since no more than four components were observed in spite of J values of at least 3 as shown by a term analysis, the number of levels in the split term is spin-limited, with $I = \frac{3}{2}$ for Ac^{227}, the isotope used. Evaluation of the nuclear magnetic dipole and electric quadrupole moments must await a more complete analysis of the spectrum, and will be reported later.

5445

Johns Hopkins Univ.

THE MOLECULAR SPECTRA OF TRITIUM AND RELATED SPECTRA; ANNUAL REPORT. G. H. Dieke. Nov. 1950. 13p. (NYO-531)

Preliminary work is reported on the photography and wavelength measurements and analysis of the Th, D_2, and T_2 spectra. In the analysis of complicated parts of the spectra a modification of the spectrum in a discharge through 200 mm He and traces of T_2, D_2, or TH was very helpful. This modified spectrum showed only bands originating from vibrationless levels at a high rotational temperature. Attempts to obtain the spectrum of T_2 free from TH and H_2 so far have not been successful, and a modification in the discharge tube is proposed. This modified tube should

also be satisfactory for accurate intensity measurements. The analysis of the molecular spectrum of He revealed a noticeable interaction between nuclear spin and orbital angular momentum. The relative intensities of H_α and T_α can be used to determine spectroscopically the relative concentration of tritium.

THEORETICAL PHYSICS

5446

Brookhaven National Lab.

REMARKS CONCERNING THE ADIABATIC THEOREM AND THE S-MATRIX. Hartland S. Snyder. May 9, 1951. 18p. (AECU-1404)

An improved mathematical formulation and solution of transition rate problems for scattering and reaction problems is given. Difficulties in connecting the time dependent and stationary methods of defining the S-matrix are noted. (auth)

5447

Brookhaven National Lab.

A NOTE ON THE U OPERATOR. Maurice Neuman. June 6, 1951. 6p. (AECU-1425)

It is usually assumed that the operator U(t) transforming the state vector from the interaction to the Heisenberg representation satisfies the relation (1) $\bar{U}(t) = U^{-1}(t)$, where the bar denotes the Hermitian adjoint. One then infers from equation (1) that (2) $\bar{S} = S^{-1}$. Here $S = \lim_{t \to \infty} U(t)$. It is the purpose of this note to show that (2) is implied by the formal structure of the theory; statement (1), however, is not. Its use amounts to an additional assumption. The failure of (1) need not be related to convergence or renormalization difficulties.

5448

Oak Ridge National Lab.

SOME THEORETICAL PROBLEMS IN NUCLEAR ALIGNMENT. J. M. Jauch and A. Simon. Aug. 29, 1951. 48p. (ORNL-1074)

The theoretical foundations for nuclear alignment have been examined with regard to the h-f coupling theory, a perturbation theory for the density matrix, and methods of detection of nuclear polarization and alignment. Special attention is paid to an objection to the theoretical prediction of nuclear alignment with h-f coupling raised by Bleaney (Phil. Mag. 42, 441(1951)).

5449

California Univ., Berkeley

CERENKOV RADIATION. Katsumi Tanaka. May 7, 1951. 23p. (UCRL-1286)

The theory of the radiation of light by an electron or proton moving with the velocity of light in an arbitrary direction with respect to the optic axis has been investigated. Use is made of the Hamilton method in the electrodynamics of anisotropic media developed by Ginsburg (J. Phys. U.S.S.R. 3, 101(1940)). It is shown that the present theory reduces to the special cases when the electron travels along and perpendicular to the optic axis.